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Editorial 1948

DURING the month, we have had cause to become more and more dubious about the future of Australian broadcasting.

In the first place, there can be no doubt now that the Government intends to exercise a strict control over the system through its new Board. I think we can assume that the powers of this Board are likely to be as wide as any little band of dictators could possibly desire.

Broadcasting and its organisation as we know it is headed for complete revolution.

I would be the last to deny that there are many aspects of broadcasting which could be vastly improved.

But the indications are that the new Board is not so much concerned about improving radio as with changing the whole setup so that it will serve the politicians first and the people afterwards.

I am all the more convinced of this because I have seen it coming for many years. I believe the intention has been in the Government's mind as long as it has been in power. The present position now crystallising is merely the fruition of plans laid long ago.

This new era in broadcasting is getting off to an atrociously bad start. Senator Amour himself has been reported in a series of statements which have dismayed and disheartened practically every section of the broadcasting industry and the radio trade.

For instance he said recently that manufacturers who declined to make F.M. sets were sabotaging national effort just as surely as were Communists—Communists in this instance being quoted as representing in the Senator's mind subversive activities.

A second statement referred to thousands of partly built F.M. sets he had allegedly seen in factories, but which for some reason were not being released.

This kind of talk is mischievous, illogical, and untrue.

Any manufacturer who is prepared to gamble on F.M. until the Government policy on broadcasting is much clearer than at present must surely be allowed to do so, or decline to do so, at his own risk, and by reason of his own judgment. The Senator no doubt will also consider citizens equally blameworthy if they refuse to buy F.M. sets when these become available, because they don't think they are worthwhile. Could anything be more foolish?

It will be a bad day for us if any Government is allowed to dictate what we shall hear, how we shall hear it, and what sets we shall buy. But that's the way it looks right now.

1948

John Moyle

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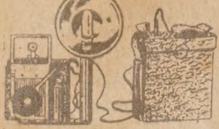
LEADERSHIP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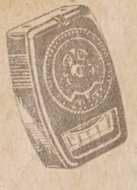
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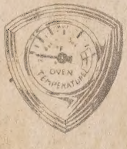

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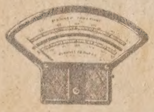
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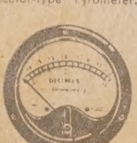

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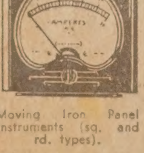

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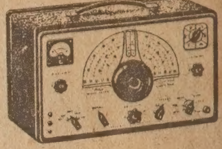
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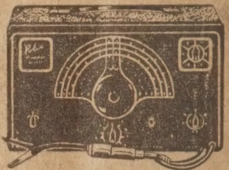

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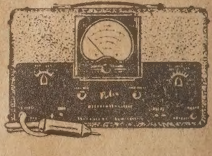

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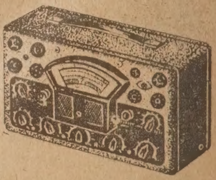
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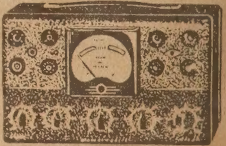
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50M. VOLTS FOR X-RAY BETATRON

Dr. Ernest E. Charlton, head of the X-Ray Section of the General Electric Research Laboratory, examines the glass "doughnut" used in the new 50,000,000-volt betatron recently completed.

A 50-MILLION volt betatron to produce high-energy X-rays that may have value in cancer treatment is announced in America in the General Electric Research Laboratory. The new device, weighing about eight tons, is a compact version of the 135-ton hundred million-volt betatron which has been used for several years in atomic research.

According to Dr. Ernest E. Charlton, head of the X-ray section of the laboratory, research shows that radiation of 50 million volts will penetrate into the body more deeply and effectively than those of lower voltage.

A machine of this size may be mounted on trunnions so the beam may be directed toward the patient at any desired angle, something hardly feasible with the 135-ton betatron.

The betatron consists principally of a large electromagnet. In the heart of the device, between circular polefaces, is a doughnut-shaped vacuum tube. Electtrons, emitted from a hot filament inside the tube, are whirled around thousands of times and are constantly accelerated while the magnetic field builds up. As the field reaches its maximum the orbit of the whirling electrons is shifted and they hit a tungsten target which they missed on previous trips. This generates a beam of high-voltage X-rays, and occurs at the rate of 60 times per second.

Dr. Charlton credited his associate, Dr. **W. F.** Westendorp, with the "biasing" technique that makes the new betatron so compact. These machines work on alternating current, in which the voltage starts at zero, builds up to maximum, returns to zero, reaches a maximum in the other direction and returns to zero again. This cycle may be repeated 60 times each second. In the 100,000,000-volt equipment, electrons are injected at the start of the cycle and removed when it reaches its first peak.

Dr. Westendorp's method involves special "bucking" coils which carry alternating and direct current. The effect of the biasing direct current is to shift the zero line of the cycle so that the electrons may be introduced earlier. Then they can be accelerated over approximatly a third of the entire cycle instead of only a quarter. With more trips around the doughnut, they acquire greater energy.

Though the basic method was described before the war in Germany by Max Steenbeck, the first betatron in America was made by Dr. Donald W. Kerst, of the University of Illinois. It was a small one, of 2,300,000 volts energy. On leave from the university, Dr. Kerst came to Schenectady and aided G-E scientists in building the 20,000,000-volt equipment. Then Dr. Charlton and Dr. Westendorp proceeded with the construction of the 100,000,000-volt device.

The Radio Scene

A.M. v. F.M.

In the present-day enthusiasm for F.M. I feel that nearly all salesmen, and some engineers as well, have given the impression that F.M. is the modern, high-fidelity system of broadcasting, and that A.M. is the old-fashioned, poor quality system. This is far from the truth. In this article, I have tried to give a general analysis of the two systems, and their possibilities. This analysis, I think, shows the balance between them to be small.

by John Moyle

ONE or two who have read my article in last month's issue have gained the impression that I am opposed to F.M. for broadcasting. In this, they are mistaken. It is my practice to approach any new subject by marshalling all the facts known to me, and from them, to attempt a logical conclusion. No engineer or scientifically-minded person can honestly do otherwise. It is the only way to obtain a rational, unbiassed viewpoint, whether the subject be F.M. v. A.M. or anything else.

I do think, however, that in the attempt to make a case for F.M., it has been presented with many qualities which do not rightly belong to it as a system. I believe, too, that most of these can be obtained just as successfully using A.M. It is possible that the total balance may weigh the scales in favor of F.M., but I do not consider the difference is nearly as great as many would have us believe.

CLAIMS FOR FM

I think it is important for radio enthusiasts and, in fact, the general public, to appreciate the comparative points of the two systems. Otherwise, as I have suggested many times, they may be disappointed in their F.M. simply because they have been encouraged to expect too much.

The main points made in favor of F.M. are, firstly, that it will allow better reduction of man-made interference and static than A.M., that it will allow more broadcasting channels to be made available, and, thirdly, that it will allow much better reproduction of music and speech.

Let me examine, in general terms, each of these claims.

Noise reduction is a function of the receiver, and, as most unwanted interference is A.M. in character, it follows that an F.M. receiver, which is designed to have no response to A.M. signals, will not receive it at all.

In the main, that is a true statement. But it is true only if the F.M. set is carefully and elaborately designed, and is kept operating at all times in a perfectly balanced condition. This in turn calls for a set which has at least two limiter valves and an efficient discriminator circuit, or their equivalent. It means, too, that the signal received from the F.M. station must be a strong one. If it is not, correct limiting action will not take place, and some noise will be heard.

Unbalance in the discriminator circuit will also interfere with noise reduction. So far, manufacturers have experienced great difficulty all over the world in producing sets which are inherently balanced, and which can be relied upon to stay that way over long periods.

All the F.M. tuners we have built so far, and all the mobile F.M. systems we have heard, do not entirely eliminate man-made interference. One can only assume, therefore, that they are not operating according to theory, despite great care in their design and manufacture. I am prepared to believe, however, that the very best experimental sets lying in some of our major laboratories are perfect in this respect. But, of course, it is the mass-produced article we must consider, such as will be bought by the listening public. It remains to be proved whether a satisfactory standard can be maintained under conditions of large-scale manufacture.

Now noise reduction is simply a matter of providing a signal at the receiver so strong that, in comparison, the unwanted noise is weak. This, of course, can be done by increasing the power of the transmitting station. In Australia, our broadcast stations are low-powered compared with those overseas. They are not even as strong as many F.M. stations.

If their power level were raised to 20 or 50 kilowatts, present troubles from noise would be greatly reduced—in fact, virtually eliminated except in very bad cases.

Concerning high fidelity, I feel that many of the advantages claimed for F.M. are not exclusive to this system at all, but are due mainly to the use of high frequencies for transmission. As A.M. can, of course, be used equally as well on these frequencies, an A.M. station can sound every bit as well as an F.M. station.

The process of modulation means the impressing of music and speech on an otherwise silent carrier so that a receiver eventually produces a more or less accurate replica of what the microphone hears.

Amplitude modulation achieves this by variations in carrier power or amplitude. Frequency modulation does the same thing by variations in carrier frequency or wavelength, the power remaining constant.

COMPARATIVE TESTS

I have heard several demonstrations of F.M., one of which occurred during the recent I.R.E. convention in Sydney, which, by direct statement or implication, tended to show how much better was the F.M. broadcast.

But in every case except one, the F.M. receiver was listening to a good programme reproduced on a high-grade loud speaker far beyond the purse of the average man. In the case of the I.R.E. demonstration an F.M. set was used with a virtual cut-off at 5 kc. to simulate a typical A.M. receiver.

This is a most unfair type of comparison. On the present broadcast band, A.M. stations are separated by only 10 kc. in an attempt to crowd as many as possible into the band. As it is very hard and expensive to make sets which can receive right up to the 10 kc. mark with a sharp enough cut-off to avoid interference from adjacent stations, designers have no alternative but to make sets which have a narrower frequency band than is needed for really high fidelity. To remedy this, A.M. stations would have to be spaced farther apart, and fewer of them used in consequence.

But this is just the reason why F.M. stations cannot be used on the broadcast band, for they occupy a much greater band-space than equivalent A.M. stations.

Therefore, to compare the two systems for fidelity, we must listen to both stations operating on the higher frequencies, where there is plenty of space available for the full sound range to be adequately transmitted and received.

Now there is no technical reason why A.M. stations should not broadcast programmes with exactly the same fidelity characteristics as F.M. stations. Consequently if we used A.M. instead of F.M. on these higher frequencies, with the same high-grade speakers and audio systems, it would be virtually impossible to tell one from the other. In addition, because the A.M. stations occupy less ether space, we could place about six of them in the same band as is required for one F.M. station.

ADVANTAGES OF HIGH FREQUENCIES

It is not inconceivable that, in the future, when the high frequencies become heavily loaded, many will wonder whether A.M. stations wouldn't have been a better proposition for this reason than F.M. stations.

These facts I think make the point that high quality is made possible not by using F.M. but by moving to the high frequencies where, at present, we can afford to allow them a much wider separation to avoid interference, and where both systems may operate to best advantages.

Another point in favor of A.M. and quality is that, as high frequency receivers are difficult to make really selective, there is no trouble in designing A.M. sets which can pass the full frequency range through their circuits. But whereas misadjustment of a comparatively minor nature can actually cause distortion in an F.M. set, much more serious faults must develop in the equivalent A.M. set to interfere with quality. And the A.M. set is fairly easy to service, while the F.M. set needs elaborate test gear to bring it back to normal.

It is true, however, that the modulation side of an A.M. transmitter is very much larger and costly than its F.M. equivalent. Modern A.M. transmitters using high level modulation must provide half as much audio power as carrier power. Thus a 20 kw. station must have a 10 kw. modulator—quite a swag of audio power. The F.M. station may, on the other hand, achieve its modulation with a few watts of audio power, and it is easier to keep fidelity high, and distortion low, at this level than it is at, say, 10 kw. However, A.M. broadcast engineers can produce high power modulators without serious technical difficulty.

The use of high-powered A.M. stations on high frequencies is, in fact, being examined in America under the name of "HIFAM." The advanges of receiver simplicity, lower band-space required, and a service comparable with F.M., are the advantages claimed, just as I have outlined them above.

USE OF PRE-EMPHASIS

In passing, it might be mentioned that in order to obtain good high note response, and to improve the signal-noise ratio still further, it is standard F.M. practice to accentuate high audio frequencies in transmission, reducing them to their normal balance in the receiver. This process is known as "pre-emphasis."

This is a highly successful scheme, and has been employed in many A.M. services for some time. Its use with A.M. broadcast transmitters is therefore quite practicable, and would improve still further their general fidelity characteristics and discrimination against man-made interference.

From all this, it is clear that A.M. must not be considered as an old-fashioned, low fidelity system. If the receivers are of the same high quality as good F.M. sets, they will sound just as good and cost less.

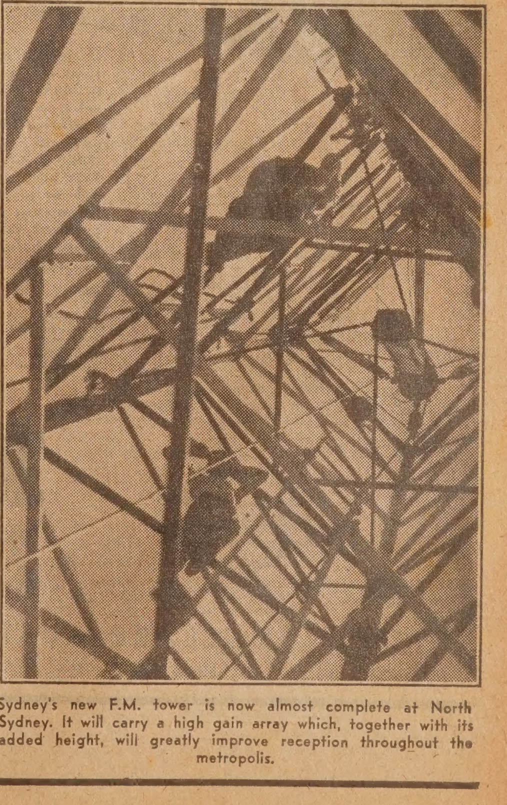
We should not forget when discussing the high fidelity position, that we are referring to a small percentage of expensive receivers which under either system will be within reach only of those who can pay for them. The natural limitations of small cabinets and speakers will not allow really high quality to be obtained from mantel receivers, which are radio's best sellers. So that the matter of the highest musical quality won't really affect the large majority of set buyers unless the market undergoes something of a revolution.

"DUAL WAVE" RECEIVERS

also be remembered that a dual-wave receiver, that is one which will receive overseas short-wave stations as well as local broadcasts, is much easier to make with A.M. The same I.F. channel and audio end can be used, with switched tuning coils as at present. An F.M. set, however, must in addition include some method of bypassing the discriminator and limiter circuits when receiving international A.M. short-wave stations, a process which adds to cost and general circuitry. The article in the series "Getting Started on F.M.," which appears on page 58 of this issue, covers this point in considerable detail.

The third advantage claimed for F.M.—that of providing extra band-space—is again made possible by using high frequencies, and has nothing to do with F.M. itself. In fact, I have pointed out that many more A.M. stations could be used in a given band than F.M. will allow.

Summarising the position, therefore, and agreeing that both systems are capable of the required high fidelity transmission, we must balance the theoretically better noise discrimination of F.M. against the fact that these stations occupy a much greater band width than A.M. stations. At the moment, this latter point doesn't worry us. Whether in the future it will prove a disadvantage, time alone will tell. When we remember the comparative complexity of the receivers required, the balance in favor of F.M. would seem to be a small one.



Sydney's new F.M. tower is now almost complete at North Sydney. It will carry a high gain array which, together with its added height, will greatly improve reception throughout the metropolis.

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TX10-4000	20 ,,	9,700 W.

*The frequency figures shown are for reduced input; the power output figures for full input.

VALVE DATA—TYS2-250	
*Maximum operating frequency	75 Mc/s.
Output Power (as class C amplifier at 10 Mc/s)	760 W.
Max. Anode Dissipation	250 W.
Anode Voltage (50 Mc/s)	2,500 V.
Anode Voltage (75 Mc/s)	2,000 V.
Filament Voltage	6.5 V.
Filament Current	12.0 A. approx.

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Technical Review

A significant advance in commercial phonograph records was made when Columbia announced its Microgroove records late in June. Up to 50 minutes of music may be recorded on a single 12-inch Microgroove record, compared with only 8 or 9 minutes on a standard 12-inch disc.

Intended specifically for use with the new long-playing Vinylite discs, this Philco recorder player is typical of units now appearing on the US market.

THE new records differ from conventional ones in two major respects: First, they are recorded at 33 1-3 rpm (standard broadcast transcription speed) instead of 78 rpm. Second, the number of grooves per inch is from 224 to 300, compared with about 90 in conventional records. This means that the groove width is approximately one-third that of ordinary phonograph records.

Recording at 33 1-3 rpm introduces certain fidelity limitations in conventional wide-groove recordings. Because of high frequency loss, high-fidelity, 33 1-3 rpm recordings (of normal groove width) are rarely made at recording diameters of less than eight inches.

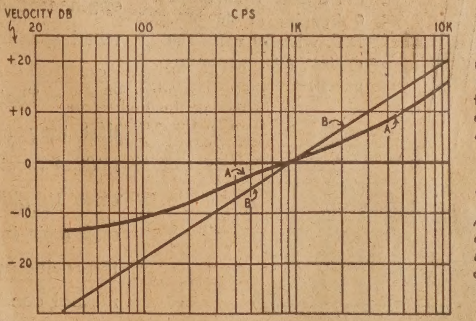
The frequency range which can be successfully recorded and played back without attenuation on a lateral-cut disc depends on four factors: Speed of record rotation, modulation index (ratio of fully modulated groove width to unmodulated groove width), diameter of record at innermost recording groove, and stylus tip radius.

RADIUS AND SPEED

Decreasing the tip radius increases the maximum frequency which can be recorded, while decreasing turntable speed decreases the maximum frequency (for a given recording diameter and modulation index).

In Microgroove records, turntable speed is reduced from 78 to 33 1-3 rpm, a ratio of about 1 to 2.3. But stylus tip radius is reduced by a factor of 1 to 3. Though the relationship between the two is not a direct one, the reduced stylus radius more than compensates for the speed reduction.

Hence, even at the innermost diameter of the Microgroove records (5¾ inches), frequency response and lack of distortion is superior to old 33 1-3 rpm recording at its innermost diameter, according to Dr. Peter Goldmark, director of engineering research and development at CBS and in charge of development of the records.



A microgroove recording curve (A) compared with a constant amplitude curve (B) of a crystal pickup.

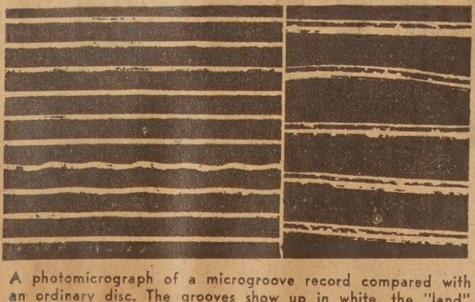
Curve A shows the recording characteristic used. It follows very closely the standard NAB characteristic, except at frequencies below 100 cycles. These low frequencies are emphasised more than in the NAB curve.

This reduces turntable rumble problems in low-cost record players, because the amount of bass boost is reduced. The records will reproduce almost perfectly without equalisation when played through a high-grade crystal pickup fitted with a .001-inch radius stylus. The arm and pickup must be designed to track with a pressure of 1-5 ounce.

Because of the fine grooves, the maximum groove amplitude must be smaller than in conventional recording. This means lower-level recording. Actual output level claimed by Columbia for these records is 4 db lower than conventional records. However, this lower level is not too important since the records are pressed on Vinylite which gives practically no needle scratch.

CANNOT BE USED

The two requirements, namely, now needle pressure and .001-inch stylus tip radius, mean that ordinary pickups and tone arms cannot be used with the new records, although some professional-type arms and cartridges can be modified to do the job. And the 33 1-3 rpm turntable speed means that only a small number of record enthusiasts will have suitable turntables.



A photomicrograph of a microgroove record compared with an ordinary disc. The grooves show up in white, the "land" areas being black.

FILTER out that HUM with ROLA CHOKES

Rola Filter Chokes have been specially designed to solve filtration problems in all modern receivers in which Permanent Magnet type loudspeakers are used.

They have been soundly engineered and conform fully to their rated specifications.

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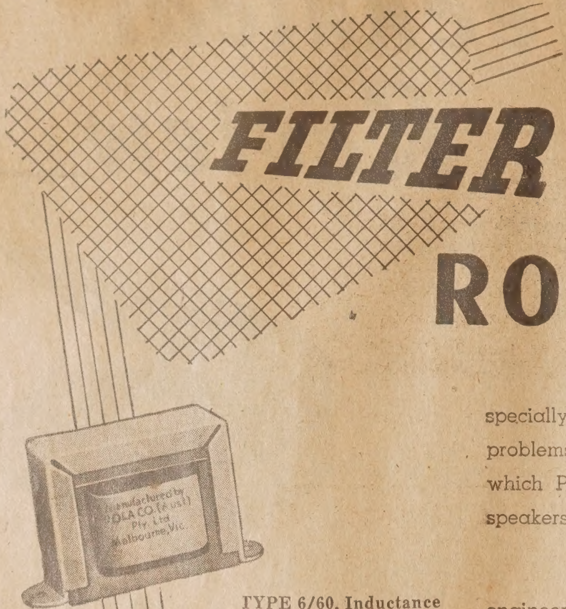
Manufactured by
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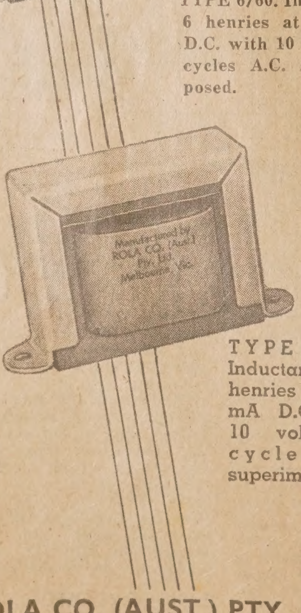
TYPE 6/60. Inductance 6 henries at 60 mA. D.C. with 10 volts 100 cycles A.C. super-imposed.


Manufactured by
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Melbourne, Vic.

TYPE 14/60. Inductance 14 henries at 60 mA D.C. with 10 volts 100 cycles A.C. superimposed.

ROLA CO. (AUST.) PTY. LTD.
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ROLA
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GAS MOLECULES AS RESONATORS

Mention of an oscillator suggests automatically either a tuned circuit or a quartz crystal to control the frequency. However, in a recent issue of RCA Review, an article by Herschberger and Norton explains the use of gas molecules to stabilise a microwave oscillator. It will be a new and surprising thought for most enthusiasts.

WHEN microwaves of the order of 1 cm 30,000Mc/s are passed through certain gases, energy is absorbed at well-defined frequencies, due to the excitation of various modes of vibration in the gas molecules themselves. One of the most clearly defined absorption lines is in ammonia gas, at a frequency of 23,870.1 Mc/s, and this has been successfully used as a frequency control for an oscillator giving stability of the order of 1 part per million.

The beauty of the system is that, unlike a quartz crystal resonator, the mid-frequency of the absorption band in a gas is independent of temperature and pressure, and no thermostatic control is required. The frequency is affected by magnetic and electric fields, but variations due to the earth magnetic field are negligible, and inside the waveguide or cavity resonator, the gas will be screened from external electric fields.

The width of the absorption band decreases, and the effective Q of the gas as a resonator increases as pressure and temperature are reduced.

EFFECT OF PRESSURE

Still lower pressures merely reduce the number of molecules present, and so decrease the absorption coefficient.

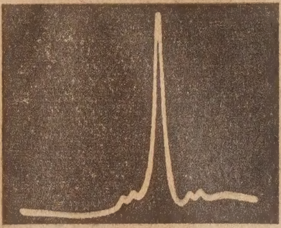
Temperature affects the bandwidth by changing the velocity of thermal agitation of the molecules and so calling for a different range of frequencies for excitation; it will be appreciated that a molecule travelling in the same direction as the field in the waveguide will, because of the Doppler effect, require a slight increase of frequency at the source before the apparent frequency, as "felt" by the molecule, reaches its critical resonant frequency.

A lowering of the source frequency will be necessary when the molecules are travelling against the motion of the field.

In a practical case a waveguide 0.43 in x 0.18in. and 12ft long was used, and with a gas pressure of 0.01 mm/Hg a loss of 13 per cent in power was obtained at the principal absorption line in ammonia, the resonant Q being of the order of 100,000.

Direct control of an oscillator, say a klystron, at this frequency, in the manner of a quartz crystal, is impracticable except with small fixed loads, owing to the difficulty of providing suitable buffer amplifiers.

With normal and variable loads the method adopted was to compare the oscillator frequency with the absorption frequency and the absorption line in the gas by a variable oscillator arranged to sweep cyclically a narrow band centreing on the absorption line. Pulses are generated as the variable frequency sweeps through the absorption line, and again as zero beat with the oscillator under control is passed.



Absorption line of ammonia at 23,870.1 Mc/s. The horizontal length of the trace is approximately equivalent to 14 M/cs.

After converting the frequency-modulated beat to amplitude modulation, the pulses are passed to a phase detector where they are differentiated and limited to ensure that the mid-point of each pulse is clearly defined. At coincidence there is no output from the detector, but deviation on either side produces a voltage which, when applied to the reflector plate of the klystron, tends to remove the error in frequency.

The paper referred to discusses the advantages and limitations of this sampling method of frequency regulation, and also shows the absorption spectra of the gases which might be usefully employed to stabilise "spot" frequencies in the range 20-25 kMc/s. An "atomic clock" controlled by absorption resonance is envisaged.

R.C.A. INDUSTRIAL "RED" TUBE

Reliability, uniformity and long life are the outstanding features of a new series of industrial "red" tubes released by RCA.

THE new Special Red Tubes— 5691, 5692, and 5693, are small type tubes specifically designed for applications requiring at least 10,000 hours life, exceptional uniformity and stability of characteristics, and rigidity to resist shock and vibration. Their counterparts are the 6SL7-GT, 6SN7-GT, and 6SJ7, respectively.

The long life built into the Special Red Tubes is the result of: (1) designing the cathode to operate at a relatively low temperature; (2) maintaining exacting control during processing to prevent deposit of cathode materials on other electrodes; (3) using pure-tungsten heaters having their legs provided with sleeves to give longer heater life with frequent "on-off" switching; (4) inspecting each assembly with extreme detail; and (5) rating the tubes conservatively.

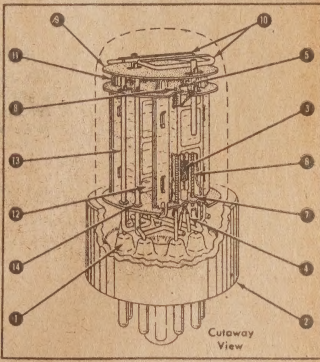
RIGIDITY

The rigidity of the Special Red Tubes is such that they will withstand 2.5g of continuous vibration at a frequency of approximately 20 cycles per second for hundreds of hours at a maximum rated voltages. They will also withstand impact shocks of 100g for extended periods, and 500 g for short periods with maximum rated voltages.

The tubes can be expected to have a service life of at least 10,000 hours.

Tubes, as their name indicates, The Special Red, are distinctive in appearance—the glass-octal types 5691 and 5692 have red bases, and the metal type 5693 has both a red base and a red envelope.

Designers of industrial and commercial equipment requiring the features of these new tubes will find the high-mu twin triode 5691 particularly useful as a voltage amplifier; the medium-mu twin triode 5692 well suited for use as a balanced dc amplifier, multivibrator, &c.



1—Low-leakage button stem. 2—Non-hygroscopic base. 3—Pure-tungsten heater for high mechanical strength. 4—Sleeves on heater legs insure good bond between heater and leads. 5—Cathode sleeves locked to mica. 6—Grid plated to minimise variation in contact potential. 7—"Stops" prevent vertical movement of grid rods. 8—Grid rods fit tightly into mica insulators. 9—Extra mica insulator provides getter shield. 10—Two getters for long life. 11—Plates held rigid by plate ears wedged into mica insulators. 12—Plates designed to minimise electron coupling between units. 13—Mount secured by five rods. 14—Reinforcing eyelets provide a firm bond between mica and supporting rods.

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1. N5GT	20/9 each
1. D8GT	29/10 each
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3482 Minimax 45 volt "B" Battery	12/10 each
3762 or P45 STD 45 volt Port Battery	12/10 each
R.C. 304 Combined A and B Battery	28/6 each

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AN IMPROVED TYPE OF DRY BATTERY

In the latest issue of "Wireless World," R. W. Hallows describes a new type of dry cell, which has recently been developed in Britain. Known as the Vidor "Kalium" cell, it promises much better characteristics than the conventional battery but requires materials which are at present, both scarce and costly by comparison.

THE Vidor "Kalium" cell has certain points of resemblance to the Ruben-Mallory mercury cell; the negative electrode is zinc in both cases, the electrolyte caustic potash (KOH) and the depolariser mercuric oxide (HgO); but the two cells are entirely different in design and appearance. They differ also to some extent in their performance, though both maintain a substantially constant E.M.F. for long periods under relatively heavy loads.

The Ruben-Mallory cell is squat in shape and reverses the familiar Leclanche construction by having the can as the positive electrode, while the small round cap at the centre of the top forms the negative connection.

RESEMBLES DRY CELL

The new Vidor cell looks almost exactly like its Leclanche dry cell counterpart. It is made in seven sizes of precisely the same dimensions as the dry Leclanche U1 to U7 series; its negative electrode is a zinc can. The positive electrode is a central carbon rod.

The only differences in appearance are that the can is enclosed (save at the bottom) in a polyvinyl chloride sheath and that the top of the cell carries not a black bitumen seal and a brass cap forming the positive contact but a tin-plated cover with a raised central boss. The "Kalium" cell is thus completely interchangeable with existing Leclanche cells.

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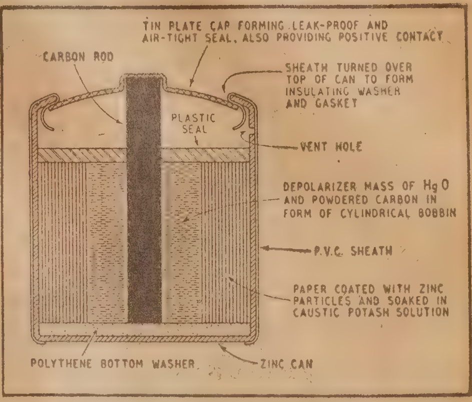
TIN PLATE CAP FORMING LEAK-PROOF AND AIR-TIGHT SEAL, ALSO PROVIDING POSITIVE CONTACT
CARBON ROD
SHEATH TURNED OVER TOP OF CAN TO FORM INSULATING WASHER AND GASKET
PLASTIC SEAL
VENT HOLE
DEPOLARIZER MASS OF HgO AND POWDERED CARBON IN FORM OF CYLINDRICAL BOBBIN
P.V.C. SHEATH
PAPER COATED WITH ZINC PARTICLES AND SOAKED IN CAUSTIC POTASH SOLUTION
POLYTHENE BOTTOM WASHER
ZINC CAN

Figure 1. This diagram shows the constructional details of the Vidor Kalium cell. It can be manufactured as a direct replacement for the conventional dry cell.

☆

The makers state that the cells store particularly well. The shelf-life is, in fact, considerably better than that of dry Leclanche cells for, after 9-12 months' storage in normal conditions and six months of "tropical" storage, deterioration is slight. The working life, to a cut-off E.M.F. of 1.0V, of cells so treated, is very little shorter than that of new cells; there is, however, a falling-off of 10 to 15 per cent in the watt-hour output, but research work is going forward with a view to making considerable improvement here.

DESIGNER'S TASK

If I read the designer's mind aright, he set himself the task of producing a dry cell as like the Leclanche as possible and containing all its good points, but none of its bad ones.

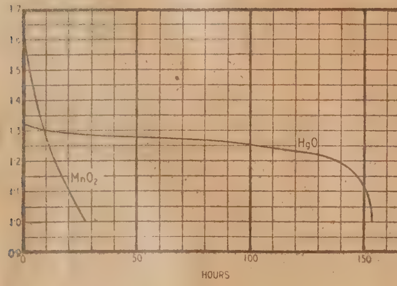

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Figure 2. Comparative performance of the "Kalium" and the "Leclanche" cell of the same size and operating into an 18.5 ohm load. The Kalium cell was discharged continuously while the Leclanche cell was discharged for intermittent 8-hour periods to allow for recovery.

☆

Fig. 1 shows diagrammatically the construction of the "Kalium" cell. The outer P.V.C. sheath is used as a precaution against any possible damage to equipment, should a can become punctured and allow electrolyte to escape. It also serves another purpose. The top of it is turned over inside the can; thus when the walls of the can are bent over to fix the tin cap in position, the P.V.C. forms an insulating washer and a leak-proof gasket. The positive electrode is normally a carbon rod, but may be of ferrous metal.

The electro-chemical reactions of both primary and secondary cells are by no means beyond doubt; a simple working picture, however, of polarisation and depolarisation in a Leclanche cell may be obtained in the following way:—

In the ionised electrolyte, when the cell is under discharge, hydrogen molecules travel in vast numbers towards the carbon rod, round which they form a resistive envelope. There is no way of preventing the arrival of the hydrogen molecules, for they are the positive ions which convey positive charge to the carbon rod. What is needed is a means of making them "move on," once they have done their job and have been neutralised by collecting electrons delivered from the negative electrodes via the circuit and the carbon rod.

In a cell with a perfect depolarising system, the hydrogen would be removed just as fast as its molecules arrived and were neutralised. The internal resistance of the cell would then remain constant, and the discharge curve of a cell would be a horizontal straight line, terminating in an almost vertical fall to zero when the electrolyte was exhausted.

The "Kalium" cell is not perfect, but curves show that the inventor has advanced a considerable way along the road towards his ideal. The E.M.F.'s are substantially constant under loads very heavy in relation to the sizes of the cells.

HIGH COST

The "fly in the ointment" as regards the "Kalium" cell is that it is considerably more expensive to make than the Leclanche. Mercury is, unfortunately, neither plentiful nor cheap, and the "Kalium" cell needs over four grams of its oxide for each ampere-hour that it gives. If we cannot have more and cheaper mercury (and there seems little immediate likelihood of that), a new task for the research chemist working on dry cells must be to discover something less costly and less scarce which can take its place as a depolariser.

Both the Ruben-Mallory and the Vidor systems have shown that better dry cells can be made—at a price. What we need is the better cell at little or no extra cost. In view of the present state of activity in dry battery research, I have no doubt that it will come our way in the not-too-distant future.

(Wireless World, October, 1948.)

The sea and its vegetation provide us with a great storehouse of valuable elements from common salt to gold.

VAST CHEMISTRY OF SEA

The search by all nations for sources of raw materials has been given a new impetus by continued industrialisation and the waste of incessant warfare. Every country on the earth is being examined in the hope that some essential raw material is hiding away there.

EVEN the air about us is made to give up what it contains for our needs in the way of industrial gases. Now the oceans have been found vast reservoirs of wealth in minerals and food.

It is not surprising that the air and the ocean are natural sources of man's requirements. They are virtually inexhaustible and have existed for countless millions of years, during which time the sea especially has been accumulating vast quantities of minerals washed into it from the land and absorbed into the sea water.

Stratified rocks originally deposited by the sea contain many minerals essential to life. The original crust of the earth is also a source of raw materials, and the action of seas, wind and rain has, by erosion, deposited in the sea large quantities of these minerals which in turn have either been dissolved or redeposited.

Considerable work has been done in determining the contents of sea water and many interesting facts have been brought to light.

SUSTAIN LIFE

It is known, for instance, that many of the rare minerals are necessary for the existence of the minute organisms which abound in the sea, and which are so necessary in their turn for the life of the larger organisms such as fish and mammals.

The sea is an enormous laboratory in which great chemical reactions are taking place all the time.

Including inland seas, the area of the oceans is about 148 millions of square miles, and in volume is estimated at about 300 million cubic miles. It is not surprising that such an enormous volume of water has a great potential wealth of mineral resources.

As far back as 1772, Lavoisier carried out a chemical analysis of sea water. Since then, more comprehensive analyses and surveys have been made. In 1873, the ship Challenger, carrying several scientists, made history by examining the bottom of the sea and giving a great stimulus to Oceanography.

SEA FLOOR

It was found that the bottom of the ocean is covered with a deposit of fine siliceous mud which has its origin in the bodies of minute diatomaceous plants and animals which exist in the sea in large quantities.

The bottom of the great oceans contains vast amounts of a calcium sediment consisting of the skeltons of Foraminifera, whilst at the greatest depths the bottom consists of nothing but an extremely fine red clay.

At varying depths are different deposits such as the terrigenous deposits of "red mud," "blue mud," and "green mud." These muds are an aggregate of mud from the land and the bodies and skeletons of organisms.

Blue mud is usually found in deep water around large bodies of land. Its color is due to a mixture of organic material and sulphide of iron. Some carbonate of lime is also present.

Green mud is found along coasts which are devoid of very large rivers and contain iron and potassium.

Red clay at the greatest depths contain silicates of alumina and iron, iron oxide and aluminium oxide, and is chiefly of volcanic origin.

It is thought that the sea contains in solution every known element, some, admittedly, in minute traces. The chemist Goldschmidt compiled a table of the chemical salts present in sea water. He gives the following elements:—Oxygen, hydrogen, chlorine, sodium, magnesium, sulphur, calcium, potassium,

by Calvin Walters

bromine, carbon, strontium boron, silicon, fluorine, rubidium, lithium, zinc, phosphorus, iodine, arsenic, copper, caesium, silver and gold.

Of the salts of these elements present in sea water, by far the greatest in quantity is sodium chloride, giving nearly 129 million tons per cubic mile, followed by magnesium chloride at 18 million tons, magnesium sulphate (epsom salts, surfers take note) 8 million tons, calcium sulphate 6 million tons, potassium sulphate 4 million tons, calcium carbonate 600,000 tons, magnesium bromide 350,000 tons. These are the most prolific salts and the ones which have proved the most useful commercially.

NOT A GOLDMINE

It is natural that many attempts have been made to extract the gold thought to be held in solution in sea water as Chloride of gold. It has been proved that gold is not held in solution at all in any amount worth bothering about, but exists mainly as the metal, which is soon removed from the water by deposition on the surface of organisms or particles of clay, and finally reaches the bottom. This has been shown by analysis of the sea bottom sludges. In many places there is no gold either on the bottom or in the water.

There was an attempt after World War I to pay the German war debt by extracting gold from the sea. The German chemist, Haber led an expedition for this purpose in a ship named the Meteor which was equipped with the means for treating the sea water. He crossed the North and South Atlantic Oceans, but met with no success.

For two years from 1924 to 1926 Haber roamed the oceans only to find that the scheme was impracticable. He found that the average concentration of gold in sea water was below one tenth of a millionth of a gram per ton. The scheme was abandoned.

AUSTRALIAN PATENT

In Australia a gentleman named George Duncan took out a patent on a scheme, and designed a plant which cost in the region of ten thousand pounds to treat 50 tons of sea water per day for the recovery of gold. It was supposed to recover 10 ounces of gold per day, but nothing has come of it.

As mentioned before Sodium Chloride is the salt which exists in the greatest quantity in sea water. This is the common salt of commerce, and is indeed the basis of the chemical industry and most essential to the life of every living organism.

Some of the chemicals made from common salt are caustic soda, soda ash, washing soda, metallic sodium, hydrochloric acid or Spirits of Salts, Sodium hypochlorite, Sodium chlorate and chlorine.

It is thus seen how important Sodium Chloride is to industry. Salt produced from the sea is called solar salt, and is mainly produced in China, India, Japan, North America and the Philippines.

In these countries the salt is recovered mainly by evaporation of sea water by the sun. Several factors must be present to ensure the success of the process.

The climate must be hot and dry with hot winds, low rainfall, impermeable soil, no dilution of fresh water. The land should be below high tide level.

Sea water is let in at high tide to the concentrating ponds, where it moves slowly from pond to pond. Calcium sulphate first crystallises out and sinks to the bottom. The "pickle" is finally pumped into the crystallising ponds. As the solution evaporates more pickle is added until at a certain point, magnesium salts crystallise out. This solution is known as "bittern," and is pumped off and more pickle added.

RAW SALT

This process is continued until finally the salt remains at the bottom about 6 inches thick. This is dug out and washed and dried. Some of it is redissolved and recrystallised to give a pure product. The residue or "bittern" is used to make magnesium compounds, bromine and potassium salts.

Another method of salt recovery widely used in the USSR and Sweden makes use of the property of salt water freezing out the salt.

The water is frozen and the resulting ice is almost pure water, while the water which does not freeze contains the salt. The ice is removed and the water, frozen several times until the remaining water is a highly concentrated solution of salt which is then evaporated artificially and the salt recovered.

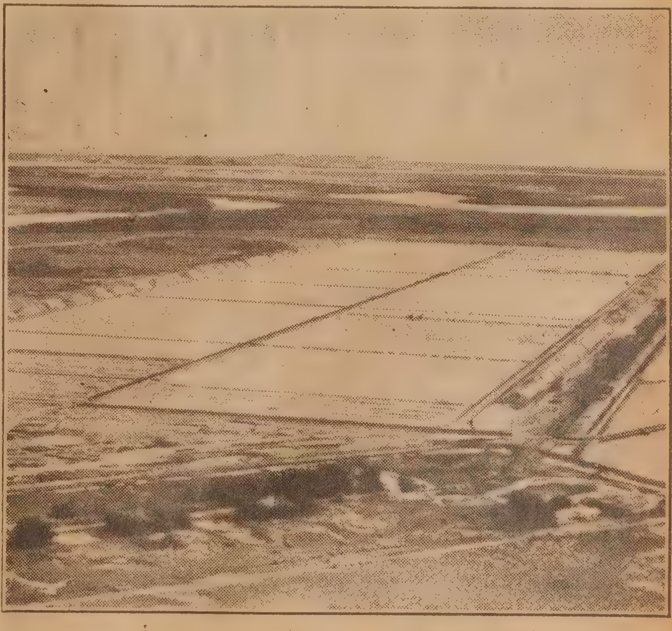
BROMINE

Bromine is a chemical widely used in the manufacture of fuel for internal combustion engines in the form of ethelene dibromide. It is used as methyl bromide for fire extinguishers and the making of dyes. Potassium bromide is used as a sedative for jaded nerves and in photography. Silver bromides are used in the films for photographic plates.

The process of extracting bromine from sea water is interesting. Briefly it consists of adding the gas chlorine to the water. This gas replaces the bromine in the bromide salts contained in the water. The bromine gas, now free, is blown out of the water by strong currents of air and dissolved in sodium carbonate solution. This is treated with sulphuric acid which again liberates the bromine which is then condensed into a liquid.

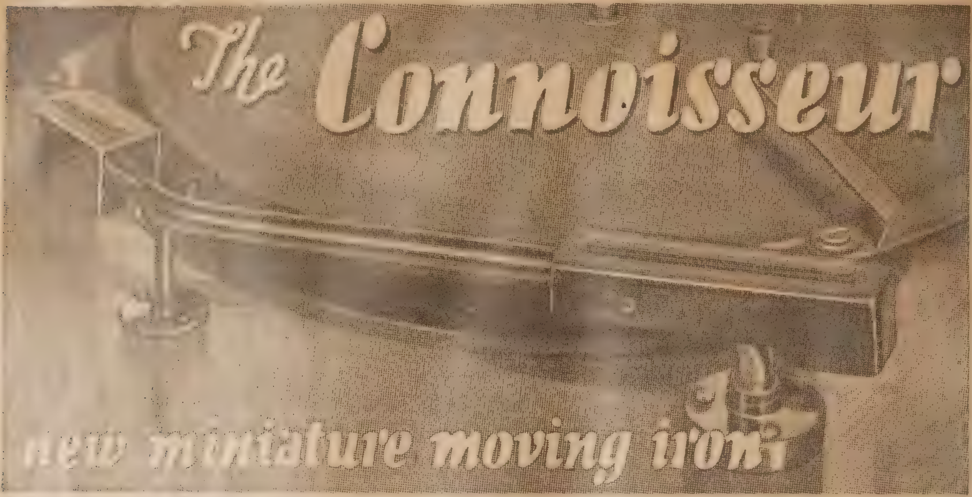
The plant required to do all this is enormous and brings to light a most unusual problem in the disposal of waste products.

(Continued on Page 83)



The great salt fields at Osbourne, South Australia.

Here's the Genuine Imported Article . . .



Here's the pick-up you've wanted and it was worth waiting for! The Connoisseur appeals as much for its technical excellence as its superbly faithful reproduction—which tests will prove to be unsurpassed. Needle chatter is reduced to the point of inaudibility, while there is no distortion of treble or bass notes, giving flawless fidelity in reproduction. The pick-up head, which is only about half the size of its competitors, is an indication of the fine degree of accuracy built into it. Every part is subjected to the severest tests before being assembled into the neatest pick-up on the market.

TECHNICAL DATA

The pick-up coil is of high impedance, being 1,300 Ohms at 1,000 CPS. The output direct from pick-up is .1 volt from a standard recording of 12 db up on the zero reference level 1 cm/sec. RMS velocity.

With our special coupling transformer the voltage across the secondary will be approximately .5 volts.

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Taking 1,000 CPS for our reference level the output falls steadily and at 8,500 CPS the loss is 5 db at 12,000 CPS, the cut is 9 db down.

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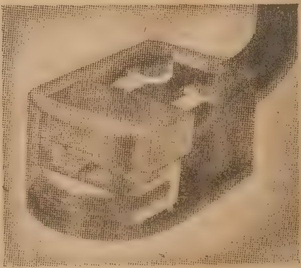

● The miniature head, shown in X-ray form is a fascinating piece of precision engineering.

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POPULAR SCIENCE DIARY

By PROFESSOR A. M. LOW,
ENGLISH WRITER,
SCIENTIST

Human Electricity

PEOPLE will tell you that they are full of electricity, that their hair crackles and that they cannot wear a wrist watch. I imagine that quite 99 per cent of this is nonsense, although I have known people sensitive to queer electric emanations, and I attribute it to what old-fashioned electricians used to call "tasting" the current in the mouth, in other words slight electrolysis of the contained liquid.

It is this sensitivity which forecast modern geophysics, when tests are made to determine the nature of underlying ground strata in searching for minerals or water.

The old-fashioned water diviner does not, in my opinion, speak the truth when he says that the twig "simply would not keep still." It is his muscles which move it and the tighter he grips the more easily are these muscles the subject of psychological effect. This does not mean that water at a depth may not be faintly felt by some individuals. But this sensitivity of electric forces usually means a very dry skin or an "acid" skin. I remember my mother telling me—and she was always right—that in the ballroom of her house as a girl she would sometimes slide across the floor in felt slippers and then light the gas by a spark from her knuckles.

Static electricity is often produced in a thunderstorm by cloud friction, and if you take a piece of brown paper about 18in. square, dry it very thoroughly and then fold it into a strip about 3½in. wide you can draw long sparks from it with your knuckle. First dry it, then dry it again when it is folded and before each experiment; choose a dry day and draw the brown paper smartly half a dozen times between your coat sleeve and your body, pressing rather tightly. Held over your head loose hair stands very quaintly on end.

Like Savages

WE are like savages in the state of our ignorance. Recently I was on my way to take part in a Brains' Trust. I tried to prepare myself for the ordeal by thinking of all the questions which might be put to me without my knowing what to reply.

After about five minutes I gave up the job, for I can ask myself questions all day long without the faintest hope of finding any answer.

Most people have heard of lemmings, a peculiar kind of rat which lives in Norway. At certain seasons or periods of years, these queer creatures rush down to the sea and drown themselves in their hundreds of thousands. I imagine that this has no connection with the biblical swine, and many theories have been advanced to explain this mass suicide. None of them is quite so ludicrous as the comparison made between themselves and those of the Nazi regime!

Can it be that the ground upon which they build their homes was at one time under the sea and that they think they are returning to the old home town, finding too late that it was submerged a hundred centuries ago? Or is it that they are Malthusiasts determined at all costs to maintain the theories attributed to their master?

I have not the slightest idea. But it is interesting. Almost as interesting as the academic priesthood which accounts for all these happenings by different explanations, and despises the enquirer for his ignorance of the origin of species.

Sound Effects

I WENT to a symphony concert the other afternoon and, as I listened, I thought how the origin of music is wrapped in mystery. As creatures whose ancestors crawled out of the sea and lived rhythmically according to the ebb and flow of the tides, we respond throughout our whole lives to rhythm. It is rhythm that rules music, which after all is merely the setting into motion of the regular waves of sound. Probably the first music was the wailing of primitive tribes as they swayed their bodies rhythmically, accompanied by hand-clapping in rhythm. In Greece, music was closely associated with astrology, and the seven-stringed lyre used to have each of its strings named after the seven planets. The ripple of the waves, the sigh of wind in the reeds, even our own breathing, are all part of the music, the rhythm of life.

The loudness of sound is measured in units called "decibels," one decibel being roughly the threshold of audibility. A whisper to your companion at the "movies" is about 10 decibels. The roar of an aeroplane engine at close quarters is about 120 decibels; and 140 decibels is about the limit of endurance of the human ear.

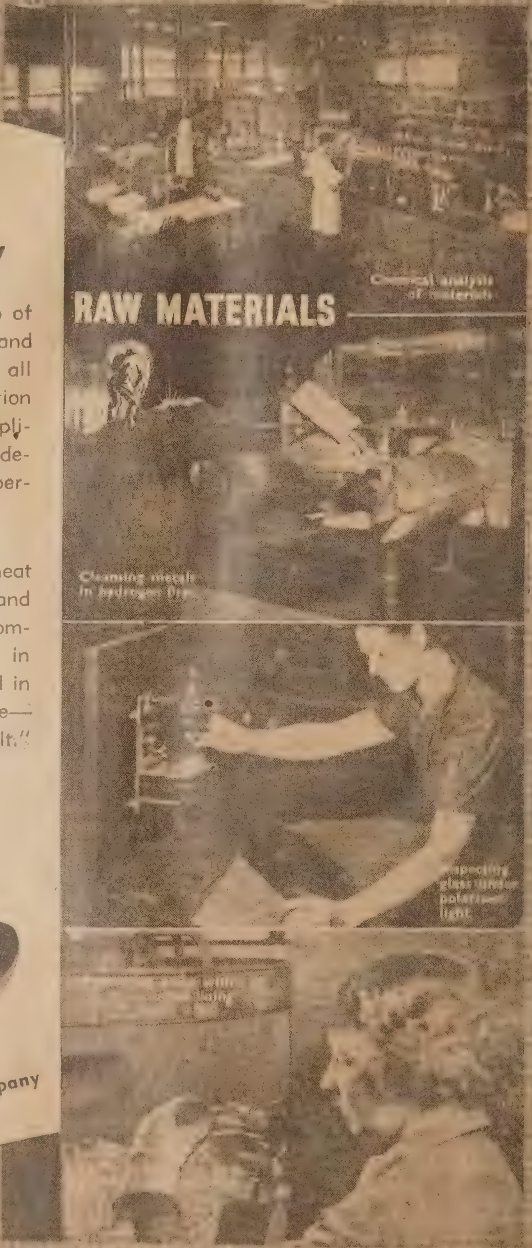
The noise of normal breathing is, at a distance of 1ft, 10 decibels. Average conversation is 65 decibels. The noise of a passing lorry 89 decibels. A lion's roar is 95; the gentle rustle of leaves is 20 decibels; and a small field-cricket shrills his call at such a high pitch that it is far beyond the range of human hearing.

Blotting-paper Clothes

WHEN rain, sucked up by the sun, falls down my neck, snow crystallised by cold enters my shoes, and fog, consisting of partially-vaporised water particles, helps to keep my volumetric efficiency, thought becomes disturbed. Besides, at this season of the year the subject of clothes leaps to the mind.

Clothes are absolutely monstrous We know full well that the atmosphere is either full of sunshine or water, and neither of these conditions is met with in the faintest degree by up-to-date attire. Nearly all cloth is composed of a number of threads placed close together and, as these strands are often twisted, it is evident that their shape and length depend upon the amount of water in them. So why pretend that the sky is always smiling or wear materials which are bound to be ruined by damp? It would really be nearly as sensible if we walked about in blotting-paper clothes.

When clothes are watered, the interstices can be observed to contain this liquid by holding various garments up to a powerful light and noting the lens-like effects of the cells, or even the separation of light which takes place. It cannot be good to use the same garments on the next day, but not because the moisture is internal. Let us suppose the sun is shining. Picture to yourself the stream of radiation from the sun. Imagine all the astounding colors, the invisible light, the cosmic rays, and then take up a large, thick, clumsily constructed chunk of cloth, and debar this life-giving light forever from your person.


RAW MATERIALS
Chemical analysis of materials
Cleaning metals in hydrogen fire
Inspecting glass under polarised light

Design for quality

- Within the familiar glass bulb of every radio valve, cleanliness and purity of materials rank above all other considerations—a condition achieved only through the application of stringent processes designed to safeguard ultimate performance.
- Chemical analysis, intense heat treatment, protective coating and microscopic examination all combine to ensure that Quality in Radiotron Valves is established in its initial stages of manufacture—that Quality is literally "in built."

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VALVES
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COMPLETE QUALITY CONTROL

Amalgamated Wireless Valve Company
PTY. LIMITED
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BRITAIN'S JET SHIP TO SAIL SOON

At the great Clydebank yards of John Brown and Company, birthplace of the two Queen liners and the mighty battleship Vanguard, the first practical gas turbine for shipping is building. Soon it will do its first bench-test run. Next year it will go into the hull of a freighter to give British Merchant Marine the most economical ship in the world.

THIS wonderful engine is not experimental. It is a revolutionary but practical power unit developed from a similar but smaller experimental model built in John Brown's engine workshops last year, and which has been under constant test for months. This experimental 500 hp engine will soon begin work generating electric power for the shipyards at a fraction of the cost of a coal-fed power house.

John Brown and Company admit they have solved only the basic problems of the marine gas-turbine, and have a vast experimental programme ahead. But they have developed an engine known to operate reliably under the exacting conditions of a long sea voyage and most importantly, that will vastly increase the carrying capacity of a ship.

Basically, this engine is an aircraft-type prop-jet, although the original John Brown engine I saw running bears little resemblance to slim, shiny aircraft power plants. It will be harnessed through reduction gearing to conventional marine propellors and will give only the same speeds as a steam turbine. Its advantages are in the tremendous saving in bulk and weight.

by

H. G. Turner

In the experimental tank where the hull designs for the Queen Mary and the Queen Elizabeth were tested, John Brown's are developing a variable-pitch marine propellor for use with the gas-turbine engine. This is expected to increase speeds.

The marine turbine differs from its aeronautical brother, because in shipping there is less need for compactness and each function of the engine can be sectionised and separated.

When installed in a ship, air for the turbine will probably be drawn through a duct set in the ship's funnel. It will be preheated, utilising the exhaust duct which will also be in the funnel, and fed into a conventionally designed aircraft turbine compressor.

Because there need not be the same consideration for weight in a marine unit as in an aircraft, this compressor is built of heavy steel castings and with a whole series of turbine blades so that tremendous pressures can be created and held.

Compressed air from this unit is directed into a separate heating chamber burning crude oil, where it is expanded rapidly and the expanding gas used to drive a turbine unit.

Biggest problem facing the designers is to reduce the size of the heating chamber without reducing efficiency. The heating chamber of the low-powered experimental engine now running at John Brown's would take a vertical height equivalent to five decks if scaled-up for a medium ship.

In the new engine, almost complete, the problem has been partly solved, but there is still much experimental work to do.

Work is also going on to find a way to eliminate reduction gearing, necessary to reduce the turbine's 5000 rpm to useful propellor speed.

Gas turbine speeds are only very slightly above those of the conventional marine turbine so their reduction presents no serious problems. Reduction gearing results in tremendous loss of efficiency, however, and tests show the loss is slightly greater with the gas turbine for some unexplainable reason.

In the John Brown engine shops the new jet engine is a pigmy among giant 15,000 hp engines now building. The compressor unit, planned to give power equivalent to a 3000 hp steam turbine, is only twice the size of a motor car engine.

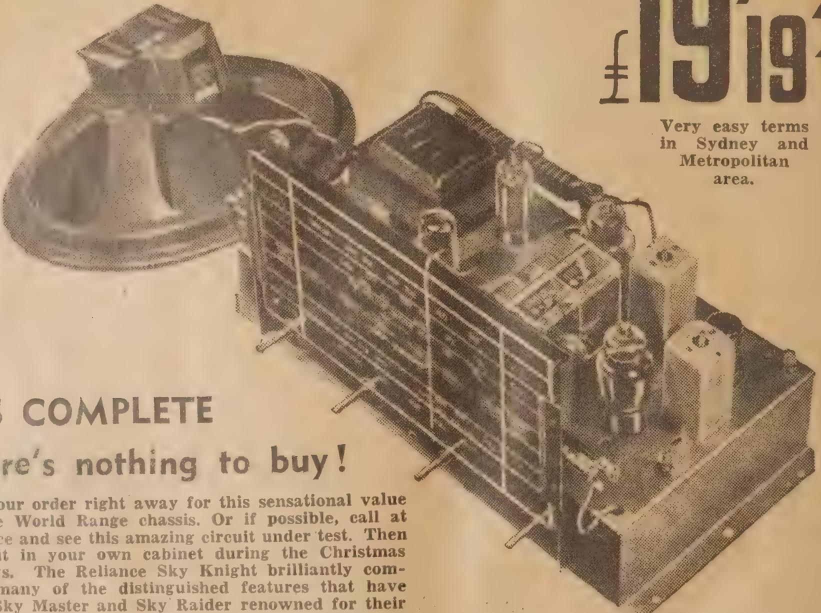
John Brown's chairman of directors, Sir Stephen Piggott, believes the gas turbine will ultimately replace all other forms of ship propulsion.

He told me it had the three advantages of light weight, small bulk and few moving parts, with consequent reliability and ease of maintenance, which make it particularly desirable to shipowners.

The new English Radar set installed in the Orontes which recently visited Australian ports. See paragraph on page 21.

FREE PACKING — FREE AIR FREIGHT

SKY KNIGHT *Full size 5-valve super World Range Unit*



£19/19/-

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IT'S COMPLETE

There's nothing to buy!

Mail your order right away for this sensational value 5-valve World Range chassis. Or if possible, call at Reliance and see this amazing circuit under test. Then instal it in your own cabinet during the Christmas holidays. The Reliance Sky Knight brilliantly combines many of the distinguished features that have made Sky Master and Sky Raider renowned for their sensitivity and long range. The chassis unit is complete, fitted with latest-type valves, and 12-inch Permag Speaker. Standardised components, built in to a tested circuit. Provision for extension speaker, FM Plug-in, Pick-up terminals, and Gramo-switch. Large modern calibrated dial. Incomparable value at £19/19/-.

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Fitted with FM Plug-in

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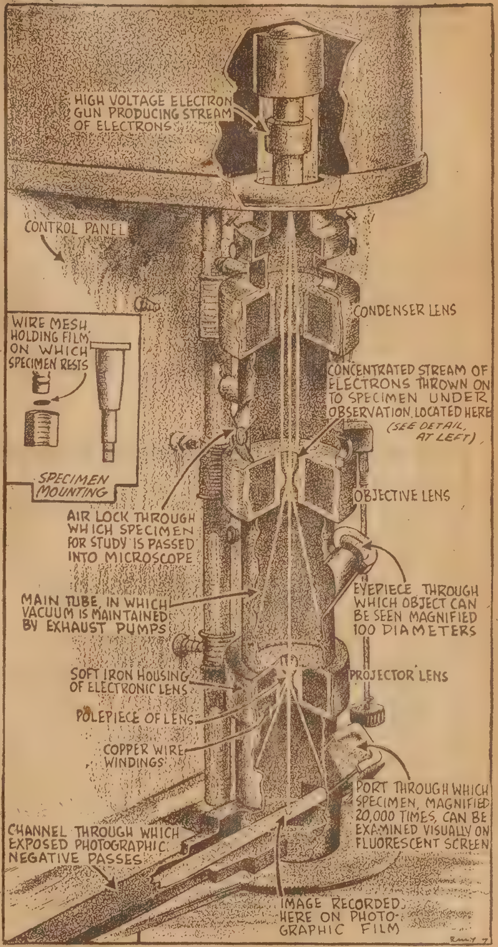
ELECTRON MICROSCOPE IN ACTION

In mankind's increasing efforts to open up new frontiers of scientific knowledge, the electron microscope has represented a tremendous step forward. Overcoming the handicap imposed by the limitation of the human eye as an optical instrument, the electron microscope has brought within the range of vision objects so tiny that previously they were regarded as invisible — objects less than 1-50,000th of an inch long.


HIGH VOLTAGE ELECTRON GUN PRODUCING STREAM OF ELECTRONS
CONTROL PANEL
CONDENSER LENS
WIRE MESH HOLDING FILM ON WHICH SPECIMEN RESTS
SPECIMEN MOUNTING
CONCENTRATED STREAM OF ELECTRONS THROWN ON TO SPECIMEN UNDER OBSERVATION, LOCATED HERE (SEE DETAIL, AT LEFT)
OBJECTIVE LENS
AIR LOCK THROUGH WHICH SPECIMEN FOR STUDY IS PASSED INTO MICROSCOPE
MAIN TUBE, IN WHICH VACUUM IS MAINTAINED BY EXHAUST PUMPS
EYEPIECE THROUGH WHICH OBJECT CAN BE SEEN MAGNIFIED 100 DIAMETERS
SOFT IRON HOUSING OF ELECTRONIC LENS
PROJECTOR LENS
POLEPIECE OF LENS
COPPER WIRE WINDINGS
PORT THROUGH WHICH SPECIMEN, MAGNIFIED 20,000 TIMES, CAN BE EXAMINED VISUALLY ON FLUORESCENT SCREEN
CHANNEL THROUGH WHICH EXPOSED PHOTOGRAPHIC NEGATIVE PASSES
IMAGE RECORDED HERE ON PHOTOGRAPHIC FILM

NO microscope depending upon a combination of glass lenses could ever reach to this "world," for the barrier created by the wavelength of light (about 1-50,000th of an inch) had been reached. At this point it became impossible for any combination of glass lenses to bring objects into vision since in order that the objects might be seen they must be looked at with light waves shorter than the smallest dimension sought.

Some years ago, American scientists decided to take advantage of the fact that electrons can be made to behave like extremely short waves.

MUCH LARGER

Although it deals with the tiniest specimens the electron microscope is very much larger than the conventional microscope. This is because of the complicated working of the instrument.

As electrons are almost completely scattered or absorbed by air, a fairly high vacuum must be maintained over the entire electron path. The instrument is provided with airlocks which make it possible for the specimen to be moved into position while the main tube remains exhausted.

The specimen is mounted within a holding "cartridge" which is placed directly in the electron stream.

The diagram-sketch here makes it possible to follow the operation of the electron microscope.

At the top is a 50,000-volt electron "gun," which emits a stream of electrons. The stream is concentrated by the electro-magnetic condenser lens, and passes on to the specimen, which is mounted on a collodium film supported by a copper grid of 200 meshes to the inch.

INTERMEDIATE SCREEN

Passing on through the electronic objective lens, the electrons are focused to form a magnified image to an intermediate screen.

Watching through the eyepiece, the operator can see the magnification of the object in the form of a "shadow" picture, magnified 100 times. It is possible, by manipulation, to bring any particular part of the object to be selected for closer examination.

Further magnification is achieved as the stream of electrons passes through the projector lens near the base of the instrument. This lens throws the final image, magnified 20,000 times, upon the lower screen.

A port is provided for visual examination of the specimen, the image appearing on a fluorescent screen.

The electronic lenses form the heart of the microscope. Each of these lenses consists of a highly magnetic polepiece through which the electron stream passes, surrounded by many miles of enamelled copper wire wound within a soft iron housing. The intense magnetic field created in this unit has the effect of a lense on the electrons.

In the base of the instrument is the chamber through which a strip of photographic film passes for the exposure of successive photomicrographs.

The negatives can be enlarged in the normal way, providing in all a total magnification of up to 100,000 diameters. Objects 1-50th of the minimum size observable with the best light microscope can thus be seen with the electron microscope.

Itself a triumph of electronic engineering, the microscope is playing a big part in the study of biology and medicine, chemistry and physics, opening up new fields of research and knowledge.

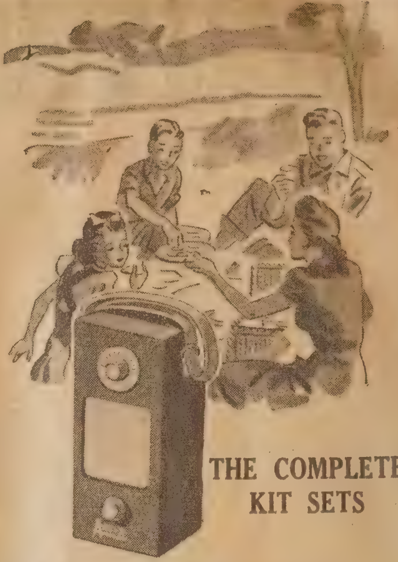
PLASTIC MAGNETS ARE CHEAPER AND LIGHTER THAN METAL TYPES

"MAGNETS" made of a plastic instead of metal have been developed and show all the characteristics of permanent metal magnets. The pieces of plastic are not really magnets because their atomic structure must be changed before they will exhibit magnetic properties, so they have been named "electrets."

They are made by liquefying plastics of either the thermoseting or thermoplastic types and then exposing them to a strong electric field. The bonding forces that hold the atoms together are realigned in the process, and when the plastic hardens it has a positive and negative pole. The electrets are less expensive to make than cobalt-steel magnets.

Set your
XMAS HOLIDAYS
to music

The hits of the season! Aegis-designed Portables which bring you extra fun on your holidays and added interest in assembling! For they're simply designed, complete to the last nut and bolt, and supplied in the famous Aegis sealed carton. Every feature of an Aegis portable kit is a quality feature which means that the finished job will have that professional touch and that reliable performance common to every Aegis product. And don't forget that every Aegis kit is fully protected with A.R.T.S. & P. Licence! Full constructional details included in pack.



THE COMPLETE KIT SETS

AEGIS "PERSONAL"

Weighs only 4½lbs., yet the Aegis PP4 is a powerful 4-valve battery operated portable only 4in. x 4½in. x 9in. Features include light-weight leatherette covered case in attractive American cloth with pencil-case slide back for easy battery change, self-contained loop aerial, midget 2-gang by A.W.A., 3in. Rola speaker, super-het circuit, Minimax 67½v. battery, adjustable plastic strap. Note the new low price, which includes batteries, but excludes valves £12/12/-

AEGIS "VOYAGER"

This compact 4-valve battery operated portable is only 8in. x 6½in. x 7in. Weight assembled is only 12lbs., yet it includes 2 Minimax 45V. batteries, long life, super-het circuit, Rola 3in. permag. speaker, Aegis special loop aerial, Aegis J10.I.F.'s, durable leatherette covered cabinet. Model KP4. Note the new low price which includes batteries, but excludes valves — — — £12/12/-.

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NEWS AND VIEWS OF THE MONTH

I.R.E. Convention

THE IRE convention, held early in November in Sydney, brought along a fine roll-up of radio engineers, many of them from interstate.

A large number of papers was delivered on a wide range of subjects, their titles being evidence of the intense activity in Australian design and manufacture.

Everyone who looked through the collection of apparatus on display was struck with the excellent standard our factories are able to maintain. Undoubtedly the intensive production of the war years has had a big effect in this regard, particularly as so many of the bigger firms have expended great effort to keep their output and design on a level to which in those years they were accustomed. In the fields of both receiver and transmitter production, the finished products were a credit to all concerned.

The papers delivered showed too that our engineers are well-informed and well able to apply their knowledge and experience. Practically every piece on display, whether a finished article or a component, was first class.

It is however, unfortunate that so little time was available for the presentation of many papers. The ground to be covered could only have been dealt with adequately in sessions many times longer than those allotted. However, the papers will presumably be brought together and be published as Convention Proceedings, where they can be studied in more detail. More than once we could feel only sympathy for a perspiring lecturer as he gradually became aware that only half his paper would have been completed before his time was due to expire.

However, those responsible for the organisation made the most of their opportunities, and with the above reservations, the Convention was most successful.

New Radar

ON the Orontes, well-known in the Australian waterways, Marconi have installed something special in the way of radar apparatus.

It is new micro-wave equipment capable of detecting a small motor-launch as near to the ship as 20ft. With its aid, it is claimed that a ship may be berthed almost as easily as though visual sighting were possible.

Only one other vessel—the Mauritania—is so far fitted with this new radar, which is at the moment undergoing what may be termed final field trials.

The use of radar for navigation of this type is probably one of its most valuable wartime applications.

Disposals Valves

THE effect of our experimental FM tuner described last month has been to increase the sales of the EF50 type of valve which is available everywhere as an ex-disposals buy. Experimenters should not overlook the value of such valves in their plans. This valve as an example is capable of first class results in many applications, particularly on the higher frequencies.

In receivers, it is an excellent RF amplifier, and for the oscillator and mixer stages particularly of high frequency receivers, it will do an excellent job.

An attractive feature is its use of full voltage on both plate and screen.

RADIO CROSSWORD PUZZLE No. 15

ACROSS

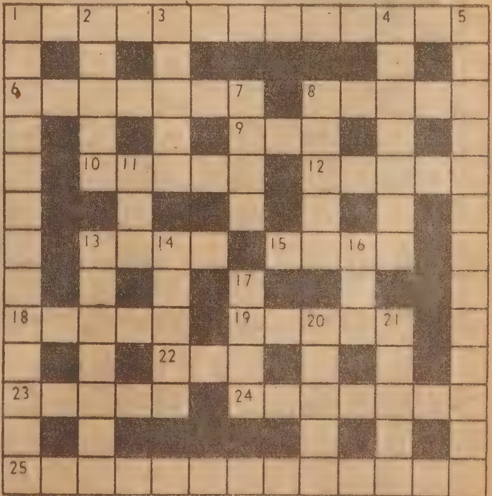
1. Four-element tubes.
6. Type of galvanometer.
8. Gateway.
9. Greek symbol for resistance.
10. Famous for X-rays.
12. Tone.
13. Type of aerial lead.
15. Instrument end.
18. For testing.
19. Wives of a Mohammedan.
22. Greek symbol for efficiency.
23. Resonated.
24. For securing resistors to.
25. Frequency allocations.

DOWN

1. Volume control.
2. Concerning ions.
3. Dismal.
4. Unit of reluctance.
5 For measuring speeds of a-c machines.
7. Other circuits branch off!
8. Drunkard.
11. Undistorted power output (abb.).
13. Changed circuit capacity.
14. Joined by conductors.
16. Poem.
17. Bream.
20. Used in solder.
21. Code.

BELOW: LAST MONTH'S SOLUTION

P	A	R	T	I	A	L	■	D	■	C	■	M
■	I	■	A	■	R	■	T	R	I	O	D	E
T	R	I	P	L	E	X	■	Y	■	U	■	A
■	G	■	P	■	N	■	S	C	A	L	E	S
L	A	T	E	R	A	L	■	E	■	O	■	U
■	P	■	R	■	S	■	G	L	A	M	O	R
A	■	W	■	K	■	■	■	L	■	B	■	E
C	L	I	M	A	X	■	A	■	P	■	M	■
T	■	N	■	R	■	A	M	B	R	O	I	N
I	N	D	O	O	R	■	P	■	O	■	D	■
N	■	I	■	L	■	P	E	N	T	O	D	E
I	O	N	I	U	M	■	R	■	O	■	L	■
C	■	G	■	S	■	V	E	R	N	I	E	R



Summer time
is PORTABLE TIME

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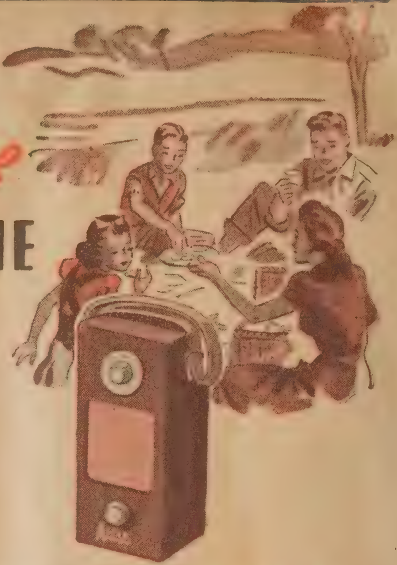

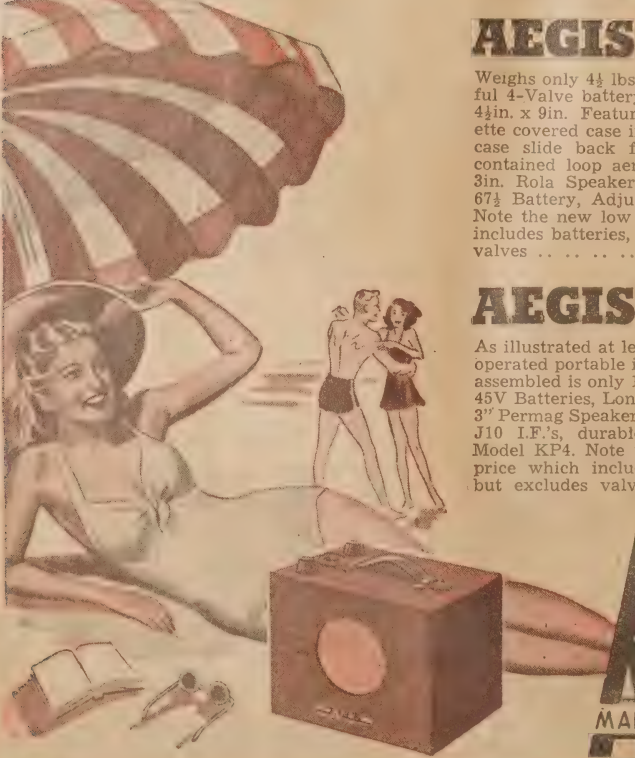

AEGIS "PERSONAL"

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AEGIS "VOYAGER"

As illustrated at left, this compact 4-valve battery operated portable is only 8in. x 6½in. x 7in. Weight assembled is only 12lbs., yet it includes 2 Minimax 45V Batteries, Long Life, Super-Het. Circuit, Rola 3" Permag Speaker, Aegis special loop aerial, Aegis J10 I.F.'s, durable leatherette covered cabinet. Model KP4. Note the new low price which includes batteries but excludes valves .. .. .. **£12'12'-**

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PERTH—
Nicholsons Ltd.

TASMANIA—
Lawrence & Hanson. Electrical Pty. Ltd.
Lawrence & Hanson. Electrical Pty. Ltd.

This makes wiring simpler, and reduces circuit complication. At a time when miniature valves are hard to get, and expensive, the EF50 is quite a proposition.

The Transistor

THE impact of the Transistor on the radio world is becoming increasingly evident with advice from overseas. As we mentioned in our last issue, it is being hailed as holding more possibilities than anything which has hit the headlines for many years.

In America, of course, it is receiving a tremendous build-up, consistent only with a firm which is convinced that it really has something. Receivers have been built using the device in every "socket" and speculation as to its final development cover pretty well every field of radio activity.

It is possible, of course, that new circuit ideas will evolve from experiment with it, so that radio gear may not look quite as familiar to us when using it. However, we have every reason to think that 1949 will see big things for it, even though their full effect may not be felt immediately. It is possible too, that other new equipment will see light before very long which will place us still further along the road to simpler and cheaper radio.

Humanity's clock

SCIENTISTS are beginning to have doubts about their knowledge of the earth's accuracy as humanity's master timepiece.

Harry A. Meahl, an engineer of the GEC, declared that the world's rotation, by which time standards are set, may vary more than a second every four years, judging from studies made at the US Naval Observatory. He pointed out that the frequency standards now being used to check radio frequencies are timed by the slightly erratic revolution of the earth, and so could be in error by more than one part in 100 million.

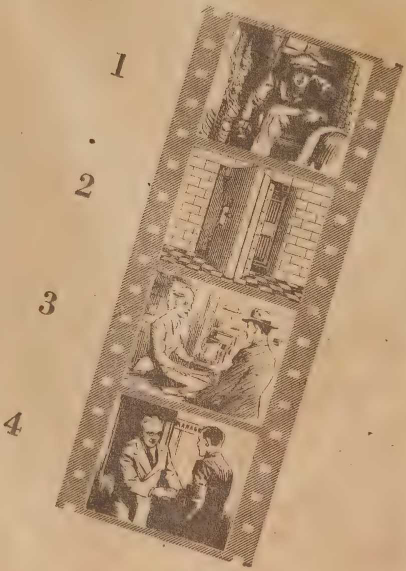
He substantiated his statement with a quotation from Captain Guy W. Clark, superintendent of the Naval Observatory: "Judged by the longitude of Mercury . . . the rate of the earth's rotation in 1929 was about one part in 20-million faster than it had been in 1909. Since 1929 the earth has appeared to slow down again, but only slightly."

Mr. Meahl said that the minor variations of the world as a timekeeper were no longer a matter of mere academic interest. "With extremely high-frequency equipment such as radar becoming more and more commonplace, and with objects radar might be tracking moving faster than sound, the earth's error could cause serious miscalculations," he declared. "With modern technology, a great deal can happen in a fraction of a second."

In lieu of the earth's timing, no other frequency standard has been fully accepted by science as yet.

HOW THE "WALES" WORKS — Services Series No. 1

CURRENT ACCOUNTS



1 If you keep money in your home, shop, office or factory, you run the risk of loss by theft or fire.

2 Money is safer in a bank than anywhere else. That is why the Bank of New South Wales holds some £200 million on deposit for its customers.

3 Why not put *your* money in the safe-keeping of the "Wales", making all payments by cheque? The use of properly crossed cheques gives you proof of payment even if receipts are mislaid.

4 The Manager of your local branch of the Bank will be pleased to supply further details of this service.

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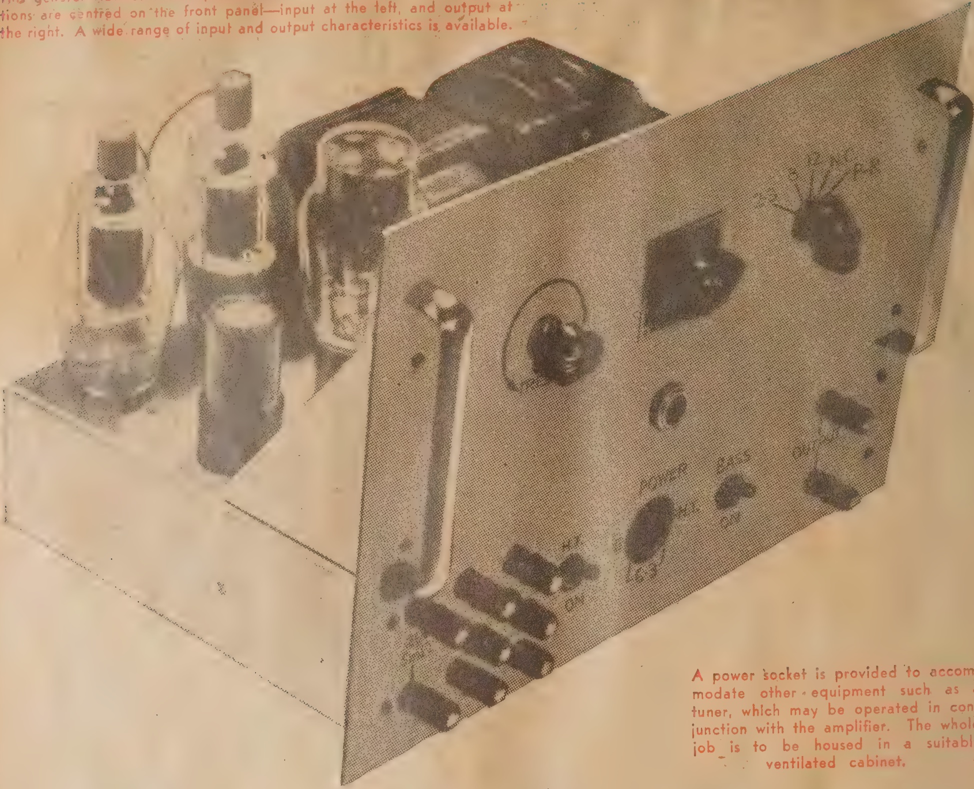
A4815F

This general view of the amplifier shows that all controls and connections are centred on the front panel—input at the left, and output at the right. A wide range of input and output characteristics is available.



A power socket is provided to accommodate other equipment such as a tuner, which may be operated in conjunction with the amplifier. The whole job is to be housed in a suitably ventilated cabinet.

A UNIVERSAL AMPLIFIER

Here is a description of an amplifier which we built up for our own workshop—an amplifier which will obviate the need to improvise each time we want to test a pickup or microphone, a loudspeaker or a radio tuner. A special arrangement of input and output terminals makes it very flexible in application, while a heater and high tension supply is available from a socket on the front panel.

WE must have wasted quite a lot of time over the past year, adapting for specific tests various amplifiers and receivers which happened to be available at the time. Every time this happened we made a resolution to build up a permanent job, instal it in a cabinet and invent a suitable penalty for anyone who "swiped" the valves or otherwise interfered with it.

The same problem occurs in every laboratory or large-scale service shop. Maybe our own effort and the resultant article will entice other readers to do themselves a similar good turn.

The first impulse is, of course, to design a piece of equipment with everything that "opens and shuts"—high power, extreme frequency response, tone compensation, calibrated controls and all the rest. While such an amplifier would be an asset in a large laboratory, it could have no appeal to the average serviceman and enthusiast, whose time and means are both subject to limitation.

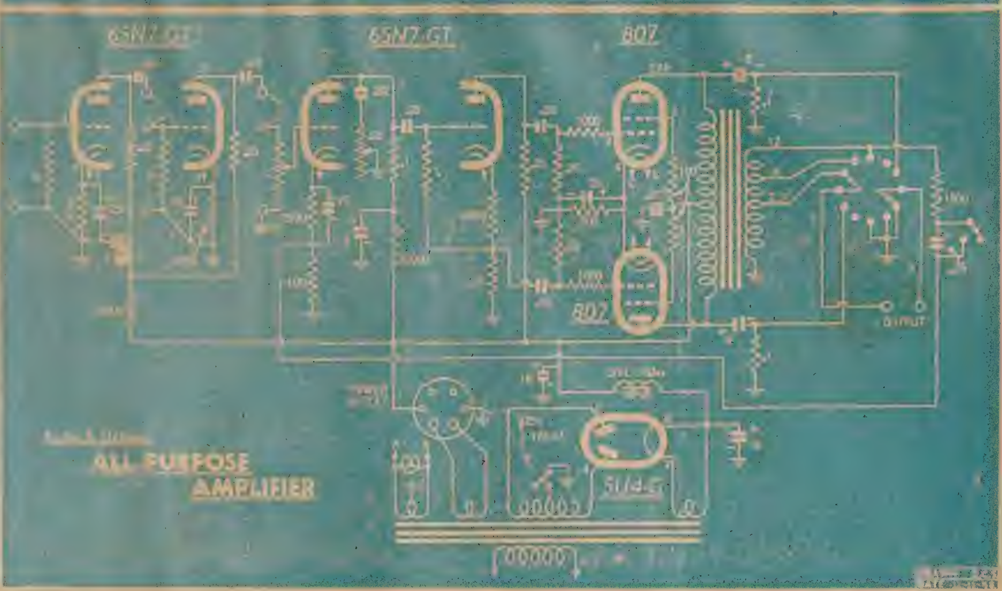
FINAL DESIGN

Our final design is therefore for an amplifier, neither difficult nor expensive to construct, but with good electrical characteristics and some additional terminals and switches to make it versatile in its application.

The simplest way to explain its performance and characteristics is to check through the circuit diagram.

For the output stage we selected push-pull 807 valves, mainly because they are so robust and inexpensive. The smaller 6V6-GT valves could be used instead, the only requirement being to see that the high tension supply does not exceed 300 volts. Operating correctly, a pair of

CIRCUIT DIAGRAM OF THE UNIVERSAL AMPLIFIER



We have drawn the input circuits in such a manner as to show how each set of input terminals is related to sucessive stages of amplification. An output impedance switch simplifies selection of the right value.

6V6-GT valves can deliver between 12 and 14 watts.

A power output of about 10 watts is adequate for most purposes, however, particularly with the increased efficiency of modern speakers. With type 807 valves, the high tension voltage can be anything from 270 to about 320, the higher voltage naturally resulting in higher power output. No change to the circuit values should be necessary.

The 807 valves are some what overbiased, so that the total current drain will approximate 100 milliamps. Allowing that another 20 odd milliamps may be required at times to operate a tuner, it is necessary to budget for a total drain of about 125 milliamps. This establishes the rating of the power transformer and choke.

POWER SUPPLY

In the original amplifier, we installed first a 285-volt, 125-milliamp transformer and this was actually in place when the photographs were taken. With a 5V4-G rectifier, and allowing for the drop in the filter system, the high tension voltage available was just under 300—ideal for 6V6-GT valves, but a trifle low for the 807's.

We did not measure the power output exactly under these conditions, but it would have been about 10 watts from the secondary.

Subsequently we were able to obtain a 325-volt transformer and this was installed, together with a 5U4-G rectifier, as per the circuit.

Only one filter choke was used in the original amplifier, but it was of a type having adequate inductance for the purpose. With less expensive chokes, a two-section filter may be required. As it was, no trouble at all was experienced with hum, even when tested with an expensive wide-range imported speaker.

The speaker has an influence on hum level which is not always appreciated. Hum components will occur, particularly at 50 c/s, due to magnetic and capacitive effects, as at 100 c/s, due to inadequacies of filtering. Hum trouble is likely to be accentuated if the natural resonance of the speaker happens to coincide with either figure.

Since the amplifier may be used at times to test loudspeakers, it is handy to have available a variety of output load tappings. It is suggested, therefore, that an output transformer be fitted having multi-tapped secondary. Transformers are availalbe for example, with secondaries tapped to suit 2.3, 8 and 12 ohm voice coils.

A primary load of about 6600 ohms P-P, will be required for the 807's under the very moderate class AB1 conditions. If you prefer to use 6V6-GT valves, the primary load will need to be about 10,000 ohms plate-to-plate.

PARTS LIST

1 Chassis 8" x 12" x 2½".
1 Front Panel 9" x 13".
1 Power Transformer 325V/325V. 125mA., 6.3V 3A., 6.3V 3A. C.T., 5V. 2A.
1 Filter Choke 30H. 120mA. 300 ohms d-c resistance.
1 Output transformer, primary 6600 ohms C.T., secondary 2.3, 8 and 12 ohms.
1 Single-bank 2 x 5 rotary switch.
2 S.P.D.T. toggle switches.
3 Octal Valve Sockets, 1 6-pin Valve Socket, 2 5-pin Valve Sockets.

CONDENSERS:

2 16 mfd 525V electrolytic.
4 8 mfd 525V electrolytic.
4 25 mfd 40V electrolytic.
1 .25 mfd 200V tubular
5 .05 mfd 400V tubular
1 .02 mfd 400V tubular
1 .01 mfd mica.

RESISTORS:

1 5 megohm.
1 2 megohm.
1 1 megohm.
1 1 megohm potentiometer.
2 .25 megohm
3 .1 megohm
4 50,000 ohm.
1 50,000 ohm potentiometer.
2 25,000 ohm.
1 4,000 ohm.
2 3,000 ohm.
1 2,500 ohm.
1 1,500 ohm.
2 1,000 ohm
1 400 ohm.
1 200 ohm 5 watt W.W.
2 100ohm.

VALVES:

2 6SN7GT, 1 5U4-G, 2 807.

SUNDRIES:

10 Terminals (6 red and 4 black), 3 pointer knobs, 1 volume control indicator plate, 1 Bezel complete with pilot lamp, nuts and bolts, solder lugs, hook-up wire. power flex, &c.

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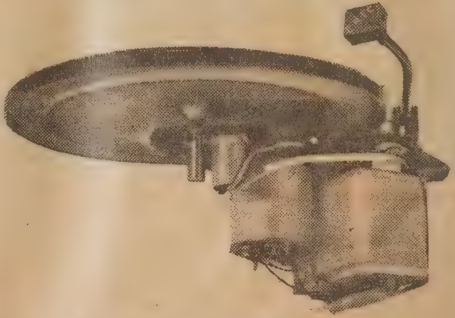
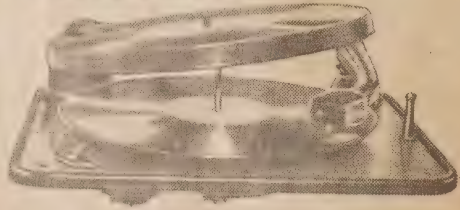


- **Garrard Model R.C.70**



- **E.R.I.C. Model AC112F**

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Type S	Record Player, synchronous type complete with magnetic pick-up.	£6.2.6
Type AC7E	Record Player, induction type motor complete with magnetic pickup.	£7.15.0
Type RC70	Record Changer, rim driven synchronous motor.	£11.17.6
Type RC65	Record Changer, induction motor.	£18.0.6
E.R.I.C.		
Type AC112F	Record Player, cast turntable, two phase motor, wide range pickup.	£14.19.6
PLESSEY		
Type A	Automatic Changer, rim driven magnetic pickup.	£18.11.4
ADMIRAL		
Type RC160A	Automatic Record Changer, rim driven, crystal pickup.	£15.10.0
RECORD-O-MATIC		
R.P.	Record Player, rim driven, crystal pickup.	£7.19.6
R.C.	Record Changer, rim driven, crystal pickup.	£15.15.0
B.R.S.		
Type E16H	Transcription turntable, 16in synchonous motor.	£56.5.0
Type R12	Recorder, rim driven, magnetic cutter and pickup.	£45.17.6

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In the circuit, it is suggested that two output terminals be fitted to the front panel and connected to an output impedance switch. In three positions, this selects directly the tappings on the secondary winding. The fourth position is blank, but the fifth position connects the terminals through 8 mfd. condensers to the 807 plates. This makes it possible to feed the output directly into a high impedance load, using the normal transformer purely as an output choke.

The general arrangement does not meet all possible variations in loading but, allowing for normal tolerances, it will be found to meet most requirements. If the voice coil leads are brought out to separate terminals rather than a switched arrangement, it is possible to work out other intermediate load conditions. For example, a 4.0 ohm load can be connected between the 2.3 and the 12 ohm tapping.

INPUT CHANNEL

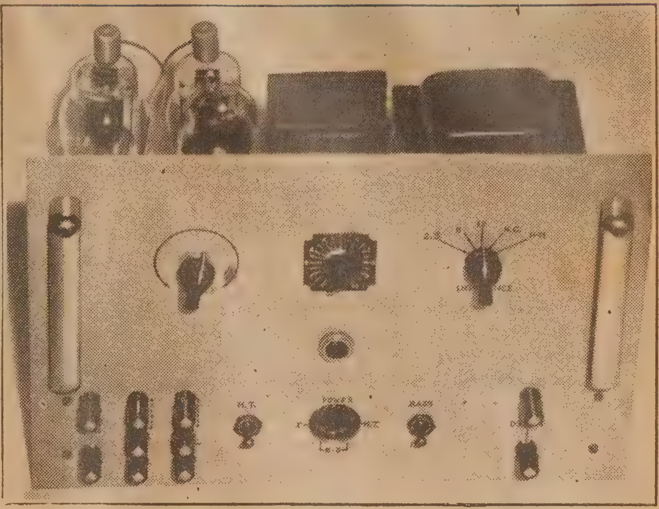
In the front end of the amplifier, it was clearly necessary to provide a system of voltage amplifiers and a phase changer which would allow the equipment to be used with a variety of microphones and pickups.

After considering various possible arrangements, we elected to use a pair of 6SN7-GT valves, which would make available four separate triodes. These valves are rather scarce at the time of writing, but fresh supplies are expected shortly from the local factories.

One triode is used as a conventional phase splitter, the other triode in the same envelope serving as a voltage amplifier.

Negative feedback is very desirable, of course, and this is taken from the secondary winding of the output transformer back to the cathode circuit of the abovementioned triode amplifier.

AMPLIFIER PANEL DETAILS



This picture shows general panel layout. The gain control is at top centre—treble control at left, and output impedance switch at right.

Although this scheme is very effective, we have not used it extensively before, since confusion can arise with secondary windings of different impedance value. Furthermore, with a poor output transformer. it is possible for phase rotation to promote obscure forms of instability. In this case, where use of a special transformer is a foregone conclusion, these disadvantages are not likely to be very important.

A rear view of the amplifier.

However, it is necessary to phase correctly the connections to the output winding. When this section of the amplifier is completed, temporarily, earth one side of the secondary and put the amplifier into operation on a signal, without the negative feedback in circuit. If connection of the feedback resistor decreases the volume, the secondary is correctly phased. An increase in volume, or oscillation, indicates that the feedback is positive and the connections to the secondary must be reversed.

To make a nice round figure, we have specified components which will allow the amplifier to be loaded up to full output with an RMS input to the particular grid circuit of about 5 volts. A volume control is connected at this point, so that signal voltages of a high order can be handled conveniently.

FEEDBACK

The feedback which can be applied, while retaining the required sensitivity, amounts to about 10 db, which is quite a useful figure. There was no sign of trouble, with phase rotation, so that more feedback could be used, if desired. To do this, simply reduce in value the 1500 ohm resistor.

With this system, a moderate amount of bass boost can be obtained by cutting a condenser into the feedback line to increase the gain at very low frequencies. A simple two-way switch provides for bass boost "on" and "off."

At the top end of the range, treble cut is provided by a simpler condenser-potentiometer arrangement. Neither of these controls are very ambitious in their function, but they

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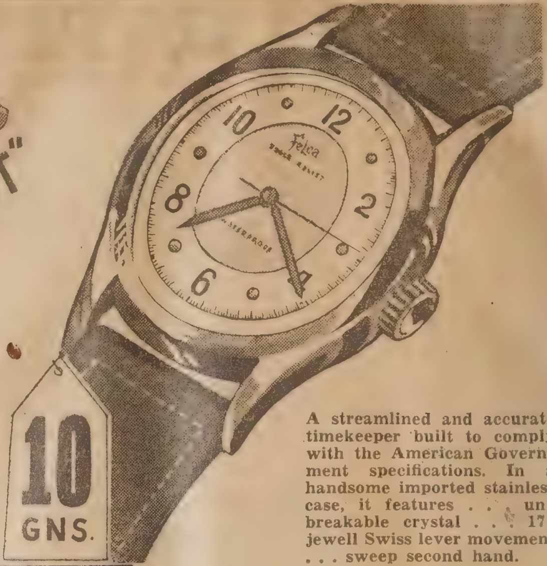

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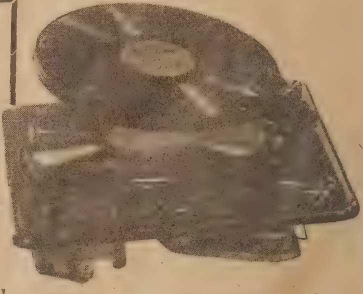

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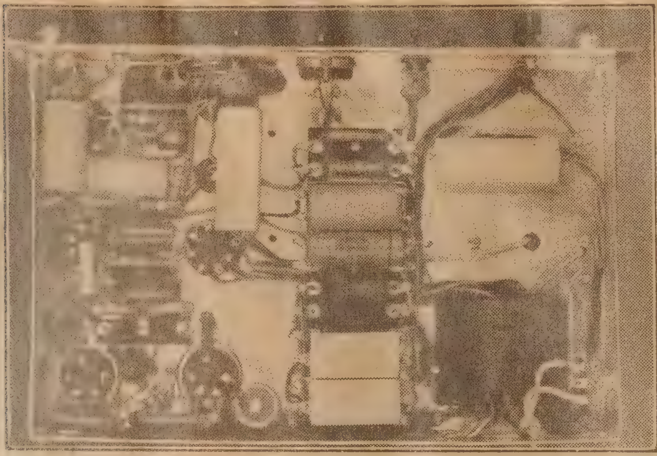

Most components are securely mounted on terminal strips.

are nevertheless simple and effective for the purpose.

If, for any reason, you wish to use the circuit with an output transformer not equipped with a multi-tapped secondary, it will be necessary to vary the value of the feedback resistor and the bass boost condenser.

For a 12-ohm voice coil winding, as shown in the circuit, the component values are respectively 1500 ohms and 0.25 mfd. If the feedback loop is connected to an 8-ohm winding, the values become 800 ohms and 0.4 mfd. For a 6-ohm winding they are 600 ohms and 0.5 mfd., while 250 ohms and 0.75mfd. apply for a 2.3-ohm winding.

FREQUENCY RESPONSE

Tested on a resistive load, the output from the secondary proved to be flat over the entire audio range. There was no noticeable drop at 18 c/s, which is the lower limit of our generator, while the loss at 15 Kc. was certainly no more than 1 decibel. Even at 20 Kc. it was only 3 db. down, while there was no sign of any peaking due to phase rotation.

On listening tests, the amplifier is very "clean" and certainly adequate for its task in life.

The remaining 6SN7-GT provides two separate stages of amplification, which can be used singly or in cascade.

Access to the first grid is provided by a pair of input terminals, bridged by a 5-megohm resistor. This channel is therefore well suited for use with a crystal microphone. The output is taken through a coupling condenser to a terminal, which can be bridged across externally to the input terminal of the following stage.

This second stage has a 2 megohm grid circuit, and its output can be bridged, in turn, to the input of the succeeding stage.

This system of terminals provides input channels with a sensitivity of 5 volts, 350 millivolts, and 25 millivolts (approx.) RMS. The 350 millivolt channel is typical of the sensitivity found in a normal gramophone amplifier, while the 25 millivolt channel is adequate for all but the least sensitive types of microphone.

Other conditions of loading can be simulated by connecting resistors externally across the input terminals, while it is also possible to connect a frequency compensating network between the successive stages.

Still another interesting point lies in the fact that the preliminary stages can be used separately or in cascade, should the need ever arise for a voltage amplifier in other equipment.

CHASSIS SIZE

Our amplifier was built up on an aluminium chassis 12in x 8in x 2½in, and fitted with a front panel measuring 13in x 9in. The whole unit was then fitted into a box, suitably provided with ventilating slots.

Looking at the front panel, the treble control is on the left, the volume control in the centre and the impedance selector switch on the right. Lower down on the panel are the input terminals, as already described, the HT "standby" switch, power outlet socket, bass boost switch, and the output terminals. The remaining item is a red indicator bezel.

The layout behind the panel is logical and requires little comment. Be sure, however, that the output transformer is mounted with the windings at right angles to those in the power transformer. If you can arrange the choke so that its windings are in still another plane, do so. As for the 807 valves, they have been let through the chassis by about an inch to keep down the overall height.

You can impart a professional appearance to the finished job by giving the panel a coat of grey lacquer. When it is dry, try your hand at lettering the various controls.

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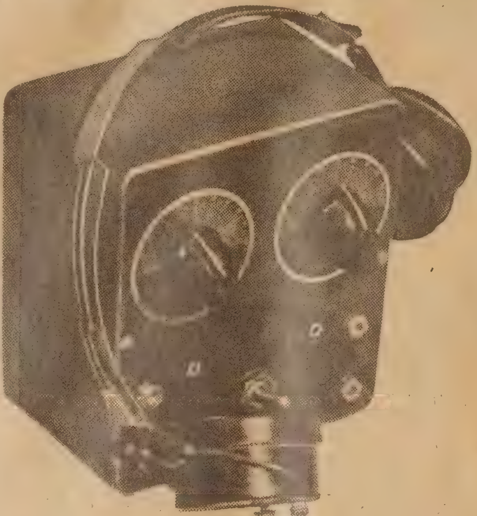

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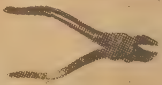

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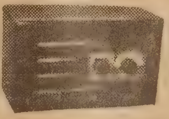

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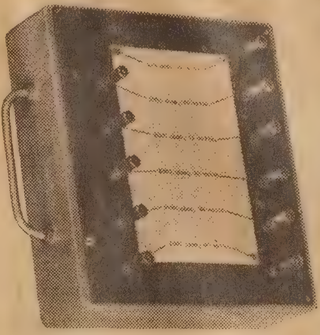
A handy unit can be made up if a number of them are fixed to an oddment bakelite panel, and mounted in a suitable wooden box. Use up any available terminals for connection to the resistors and mark their individual values and wattage ratings on the front panel.

In the unit illustrated above, we grouped four 5000-ohm 55-watt resistors, a 600-ohm 40 watt and a 1000 ohm 40 watt all of which were picked up at odd times for a couple of shillings each.

By using the resistors singly or connecting them in a series or parallel combination, it is possible to make a variety of resistance values ranging from about 290 to 21,600 ohms, with a high wattage dissipation in all cases.

An obvious use for a resistor bank of this nature is for testing amplifiers and modulaters. The bulk of the output can be dissipated in the correct resistive load with just a small portion, if desired, tapped off to a monitor loudspeaker.



Every item in this resistor box is an inexpensive oddment but the result is a very useful piece of equipment. An important item is the typewritten card which shows the value of the resistors inside.

The resistors can also be used for checking ohmmeter and bridge instruments or to drop the voltage temporarily while setting up a transmitter.

The exact values chosen will depend largely on what resistors you have acquired. The important point is to have them available in a form where they are acceptable and convenient to use.

Capacitances From Twisted Wire

THE design of U.H.F. receivers often calls for a capacitance of very low value, say from 1 to 20 pf. The most notable example is the coupling condenser from a separate oscillator to the grid circuit of a high gain pentode mixer.

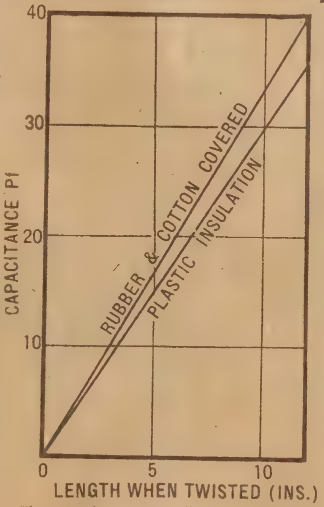
In this case the capacitance required lies generally between 2 and 5 pf, and there is an advantage in being able to vary it and observe the effect on performance.

A simple low capacitance condenser can be made up by twisting two short lengths of hookup wire, tightly together. The capacitance can then be varied by the simple process of slackening the twist or clipping the length of the wire until the desired results are obtained.

The exact capacitance will depend, of course, on the nature of the wire and the degree of twist, but some idea of its value is given by the above curve. The readings were taken, by the way, on the capacitance bridge described elsewhere in this issue.

Using ordinary plastic covered hookup, it was found that a 10-inch length, tightly twisted, showed a capacitance of 30 pf. This is a handy figure to remember. Shorter lengths scale down in a linear fashion, so that a 5-inch length has a capacitance of 15 pf, and a 2½-inch length reads as 7.5 pf.

A further test indicated that rubber and cotton covered hookup of the traditional Belden variety showed slightly greater capacitance per unit length, due apparently to a difference in the dielectric constant of the insulation.



This simple curve will be found to apply for most ordinary types of hook-up.

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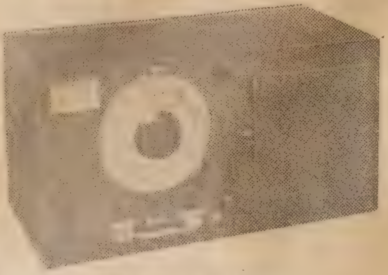

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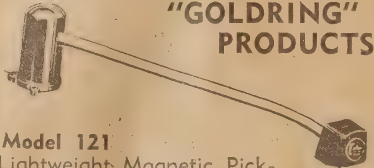

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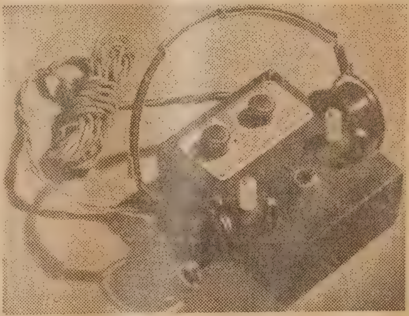

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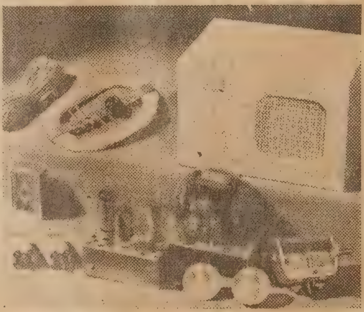

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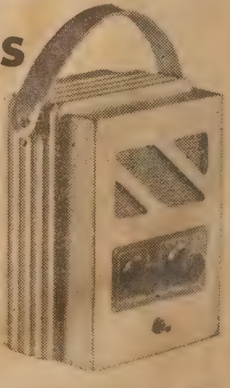

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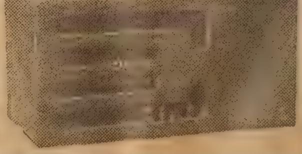

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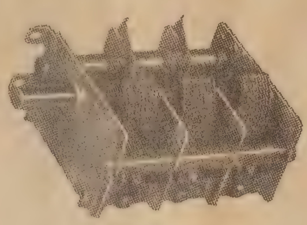

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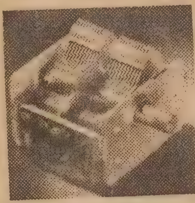

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Here's your answer, Tom!

For the purpose of this column, your name, too, can be Tom. Make a list of the questions which puzzle you and, if we consider them of sufficient general interest, we will answer them for you at the first opportunity. Our address is Box 2728C, GPO, Sydney.

I would like to know why the I.F. transformers in commercial sets have a 50pf (approx.) condenser across both windings. If the 50pf condensers improve the set, why is it that R & H circuits do not use them?

The answer to this one is bound up entirely in the conventions of drawing schematic circuits. In trying to keep our circuits simple, we do not show condensers across the I.F. transformer windings, nor do we indicate the presence of iron slugs—variable or otherwise. The condensers and slugs are an integral part of the transformer and for every reader who is confused by their absence there might be several who would be found wiring them across the terminals of the transformer, if they were shown separately in the circuit.

In actual fact, all ordinary I.F. transformers have a condenser of between 50 and 150 pf connected across each winding, the exact value depending on the design and purpose of the transformer. Where the inductance of the winding is fixed, the condenser is always adjustable and is generally of the mica compression type.

On the other hand, when the inductance of the winding can be varied by means of an iron slug, it is possible to use a fixed value of tuning condenser which can either be wired across the coil directly or moulded into the base of the transformer. In either case, they are essentially part and parcel of the transformer and do not have to be added as an extra component.

So Tom, we are quite conventional after all.

I have recently built up a 4/5 valve superhet, which goes well except that there are troublesome "birdies" at several spots on the dial. How can these be cured?

We agree that unwanted birdies are a nuisance, be they in the roof, the lettuce patch or the radio. Unfortunately, perhaps, the ones in the radio are not amenable to discipline by catapult, pea rifle or scarecrow.

Being technical, it is very difficult to explain the presence of birdies in a superhet. In fact, we have never yet seen anyone do it without presenting such a mass of figures that the reader is tempted to turn straight to the end of the story to see what happens. In actual fact, nothing ever does.

To begin with, "birdies" are those odd little whistles which appear as one tunes across certain stations, being just loud enough to be annoying. They are quite distinct from the strong whistle which is produced when a set is actually oscillating. It appears that most birdies are the result of cross-modulation effects in the first valve and they are specially noticeable in 4/5 valve superhets, where the first valve is a converter.

EFFICIENT COIL

The first requirement, therefore, is to use the most efficient possible aerial coil—one that has high "Q" and moderate coupling only between primary and secondary. See that the circuit tracks properly so that, as far as possible the only signal of any magnitude fed to the converter grid is the desired one.

Check the operating conditions of the converter to make sure that all potentials and especially the oscillator grid current checks up with recommended ratings.

Keep the aerial terminal and lead clear of the I.F. channel and avoid using an excessively long aerial for local station reception.

Birdies are most likely to be present when strong local stations are on the air and, to prove the point, you will often notice that they disappear when one or more of the local stations closes down for the night. Distant stations are then heard quite clearly without a trace of a heterodyne whistle. You can get the same effect by moving out into the country but that is rather a big step to take for a few birdies. There is also an even chance that the two-winged variety will drive you back into the city for other reasons.

I am making my first attempt at radio building with a "Minivox." All I can get from it is a screech at a certain position of the condenser. The screech varies in loudness with the volume control.

Well, Tom, every time we describe a reaction set like "Minivox" we get a handful of letters back asking the same question, so apparently the function of the reaction control is still not widely understood.

The whole point of the matter is that small receivers depend very largely on the reaction circuit in the detector to provide gain and selectivity. If it were not for the reaction circuit they would be hopelessly broad and insensitive—in fact, not very much better than a crystal set.

As the reaction control is advanced, be it a condenser or potentiometer, the gain of the detector valve increases, but a point is ultimately reached at which the detector suddenly bursts into oscillation on its own account.

When this happens, the set produces a series of whistles as it is tuned across the various station carriers and the programmes are hopelessly distorted. At the same time the set feeds its whistles back into the aerial, to the dismay of others in the district.

If the reaction control is advanced still further, the oscillation may become so fierce that it produces a loud squeal or howl which completely blots out even the whistle on station carriers. The set is then well and truly out of control.

The whole idea therefore, is to keep the reaction control always at a point just below oscillation.

Turning it back a fraction will make the signals very much weaker, while turning it forward by an equally small amount will produce a growl or whistle. Under these conditions the detector gives maximum gain and selectivity and the set is doing its best towards hauling in the wanted stations.

The best setting of the reaction control varies somewhat as the main tuning condenser is rotated and a certain amount of care is therefore necessary at all times to get the best out of a reaction set.

Of course, if the signals are too loud, they can be reduced in strength either by turning back the reaction control or turning back the volume control, if this is provided. For the rest you can experiment with the length of aerial, its connection to the aerial coil and so on, but this is another story.

The essential point to grasp is that whistling or howling indicates that you have turned the reaction control past its optimum point. Like the choke on your motor car there is one position only which gives smooth running on a cold morning and you have to discover it by trial and error. Too much or too little and your engine stops. Not that this has much to do with radio, of course, but you get the idea!

Could you possibly describe the construction of a superhet using the same stage-by-stage principle as adopted for the "IK5-Four"? I think the "Multi-Talkie" would be ideal.

Sorry, Tom, it can't be done—at least not in the way that we did the "1K5-Four."

You will remember that we described the detector circuit first then added the audio stages and, finally, the R.F. stage, the set remaining a going concern the whole time.

COMPLETE CIRCUIT

Much as you may want to do so, you can't treat a superhet that way. The detector circuit normally operates at the intermediate frequency only and is therefore incapable of receiving broadcast stations on its own account. The same applies to the I.F. amplifier. You would have to add the converter valve before any signal could be heard. In other words, the set would have to be more than half built before the stations would become audible.

With the "Multi-Talkie" and similar circuits there is the additional complication of the filament circuit and we feel that the "Multi-Talkie" would be the very worst set for any beginner to tackle.

If you want a superhet receiver it simply must be built in one lump.

We often see coil data for different sets using wire of various gauges and, since it is necessary to purchase more than one's immediate requirements, this means a certain amount of hardship. Would it not be possible to standardise on coil specifications and even publish a simple chart from which the desired information could be readily obtained by using a straight edge?

We can fully appreciate your problem Tom, since we too went through the same process in our younger days. Back in July, 1942, we published some basic coil data and ever since have endeavored to conform to this as far as possible. Variations are inevitable, however, to meet the requirements of different valves, or instances where the set has to fit into a small space.

More recently, when designing the "All Band T.R.F." we considered it desirable to evolve new data, giving an amended frequency coverage, and this will be taken as a pattern for similar designs in the future, together with the suggested standards of coil connections.

It is possible to vary the gauge of wire and former diameter to suit materials on hand, and you will find a complete discussion of this a few months back in the Beginner's series. If you follow out the suggestions made there, you will probably be closer to the mark than when using "ready reckoner" methods for designing coils. Initially there is a lot more to the design than using a straightedge and scales. Even after following approved methods, it is still necessary to make allowances for circuit effects which do not enter into the calculations.

I have a portable receiver and, by reversing the leads on the A battery, it almost doubles the punch. Is there is any reason why the set should not be operated in this manner?

Way back in the days when few people knew much about grid bias, a favorite trick was to reverse filament connections, noting which way gave the best results. Since then, however, valve manufacturers and set designers alike have grown to appreciate the importance of bias and receivers are designed to give the required gain and power without drawing excessive current from the batteries. This initial design involves careful study of the operating voltages and, in particular, the grid bias, on all valves.

In a battery valve, the bias voltage is always quoted in respect to the negative filament pin. Because the other end of the filament may be positive by 1.5 or 2 volts the ultimate bias voltage varies between the grid and different points along the filament. Obviously the "average" bias is that which exists between the grid and the centre of the filament.

In a 2-volt valve with nominal 4.5 volts bias, the voltage between the grid and the centre of the filament is actually 5.5 volts—the grid being 4.5 volts negative with respect to earth and the centre of the filament 1 volt positive with respect to earth.

If now we reverse the connections to the A battery, the centre of the filament becomes -1 volt with respect to earth so that the effective average bias is no longer -4.5 but -3.5. This change will increase the plate current of the valve by at least 50 per cent, causing it to amplify less favorably, to wear out more quickly and to impose unnecessary drain on the B batteries.

Since this effect will be apparent to some extent in every valve in the set, the net result can be drastic.

You say that the punch of the set is almost doubled, but this is unusual. It could be that there is a special feature design of the set which allows the punch to be so marked, but a milliampmeter in the high tension circuit would support the story we have just told.

Your best plan therefore, Tom, is to connect the A battery exactly as the designer intended.

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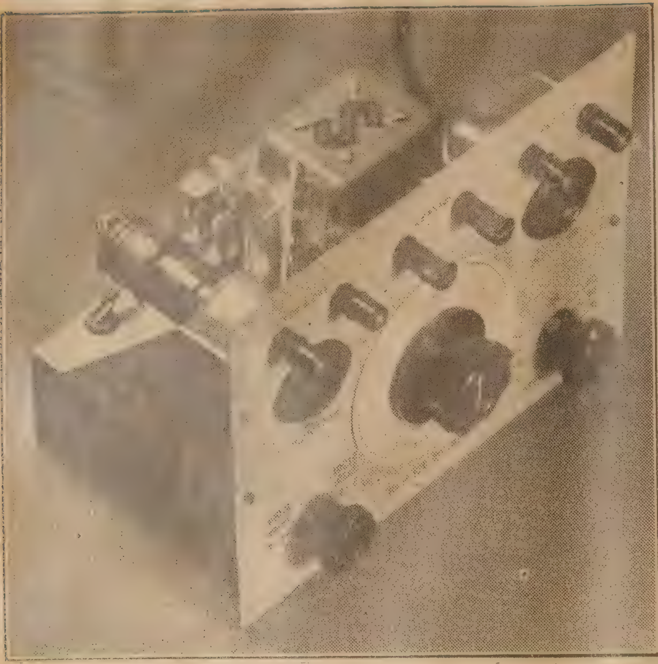


The finished job is compact, and makes a most attractive addition to any radio workshop.

STANDARD R.C. BRIDGE

Despite its classic name, there is nothing mysterious about this instrument. Easy to build and simple to operate, it will measure positively all values of resistance and capacitance likely to be encountered in everyday experimenting and service work. In addition, it indicates the leakage and power factor of condensers and can be used with external standards, to measure inductance.

by Raymond Howe

ONE often meets components whose color coding has been mutilated, or which, perhaps, is quite unmarked. This bridge allows both condensers and resistors to be checked which, otherwise would be useless.

It will be possible to read resistance from 1 ohm beyond 50 megohms and capacitance from 1 or 2 pf. beyond 50 mfd. Although the scale reading is rather cramped between 50 and 100 on each scale, it is possible to read approximate values to 100 megohms and 100 mfd respectively.

SIX RANGES

Thus, the six ranges provided cover all values of resistors and capacitors normally encountered.

In addition, facilities are provided for reading the percentage power factor of paper and electrolytic capacitors and noting their leakage. Lastly, the range switch is arranged so that two terminals on the front panel can be brought into circuit to enable components to be matched, irrespective of their value. This feature applies equally to resistance, capacitance and inductance.

It would be helpful to measure inductance directly, of course, but unfortunately, the circuitry which would become necessary and the provision of suitable inductance standards would put the resulting instrument right outside the scope of the average man.

It is possible to balance inductance against capacitance standards, but this calls for a special bridge circuit quite distinct from the one necessary to cope with resistance and capacitance alone. In addition, it is necessary to allow for variations in "Q" factor and the effect of direct current through the coil.

Appreciating these points, we have this bridge simple with the thought in mind that a full-scale inductance bridge can be covered in a future article.

BRIDGE CIRCUIT

The bridge operates on the principle of the familiar Wheatstone bridge, in that the calibrated control forms two of the arms and the selected standard and the unknown component the other two. The voltage source for the bridge is the 5 volt winding on the power transformer, and visual indication of balance is provided by an electron ray indicator tube, more commonly known as a "magic eye."

A voltage amplifying stage between the bridge and the grid of the indicator tube greatly increases sensitivity and accuracy, and permits the use of the readily available 5 volts from a filament winding on the conventional power transformer. The latter point is important, because it avoids the necessity of obtaining a special transformer.

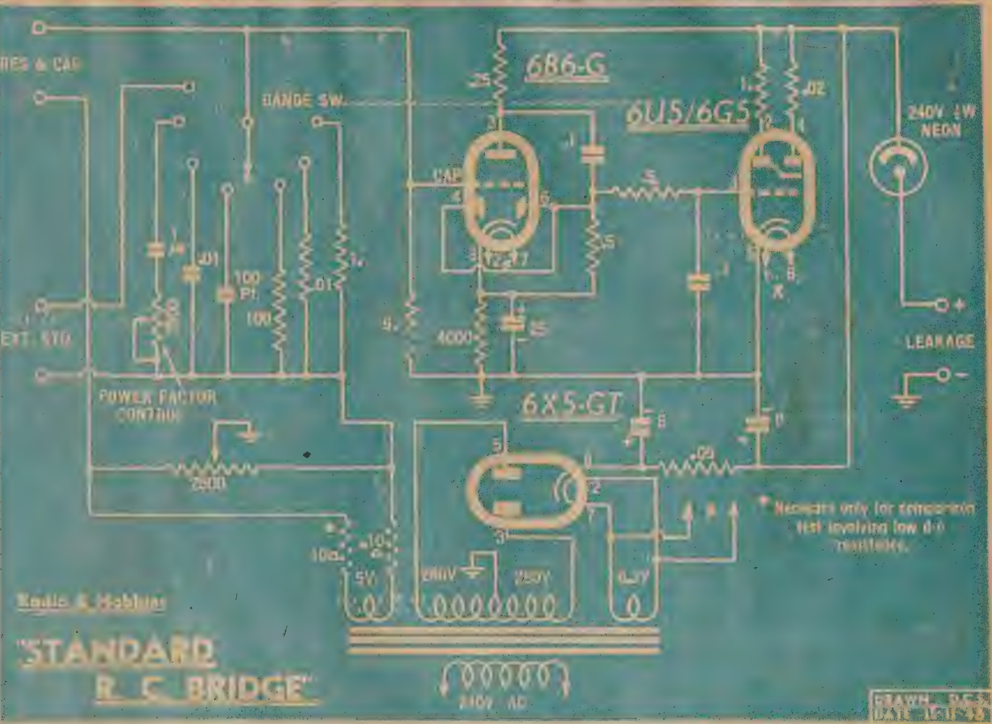
The bridge circuit itself simply consists of a 2500 ohm wire-wound potentiometer, a single pole multiposition switch to select six standards and four terminals on the front panel. Two of these are for the unknown component, and two for the introduction of an external standard or component for matching purposes.

The power requirements are obtained from a power transformer of the smallest size available.

As far as the d-c supply is concerned, the small 150-volt 30-mA "Minivox" transformer would do. Unfortunately, there is only one filament winding, and this could not be used for the filaments and the bridge as well, without introducing unwanted capacitance across arms of the bridge and from bridge arms to earth.

However, if you have one of these transformers on hand, it can be used provided that you have a separate filament transformer for the bridge

CIRCUIT DIAGRAM OF THE STANDARD R.C. BRIDGE



Full circuit details are shown above.

supply. But do not use for the bridge source an auto transformer type which operates from an existing filament winding.

VOLTAGE

When using this lower voltage transformer, the voltage across the first filter capacitor will not be much over 200 volts. It would be desirable to reduce the value of the resistor in the filter so that the output voltage is at least over the 150 mark.

The sensitivity of the instrument would be lower and the indicating tube not quite so bright, but, nevertheless, satisfactory operation should be obtained.

We used a transformer with a 280-volt 40-mA secondary, and with 5-volt and 6.3-volt filament windings. This transformer is the smallest size readily available next to the type already mentioned.

Obvious choice for the rectifier is a 6X5-GT, because of its 6.3-volt heater and separate cathode. Because of the extremely light high tension drain, a resistance-capacitance filter suffices and serves the double purpose of filtering and dropping the output voltage down to the 250 volt mark.

You will note that this full voltage is not supplied direct to the target anode of the electron ray tube. A .02 megohm dropping resistor is connected in the feed to this anode, so that the actual voltage applied is about 230 volts. By keeping this voltage down to between 220 and 230 volts, the life of the indicating screen is increased without materially affecting the readability of the "eye."

The voltage amplifier is of conventional design with optimum values of cathode and plate load resistor. You will note that it employs a diode-triode of the 6B6G or 75 type. The diode-pentode type could be used, but would require the addition of a screen dropping resistor and bypass capacitor. However, the triode provides sufficient amplification for satisfactory operation of the bridge.

The 5 megohm resistor in the grid

PARTS LIST

1 Metal case 9 1/16" x 6 9/16" x $5\frac{1}{2}$". (with corner fills for securing the front panel).
1 Front panel $9\frac{1}{8}$" x $6\frac{5}{8}$".
1 Chassis 8" x $5\frac{1}{4}$" x $2\frac{1}{4}$".
1 Power transformer 280v. per side 40 mA, 6.3 v. and 5v.
1 6X5GT.
1 6B6-G.
1 6U5/6G5.
1 240 volt $\frac{1}{2}$ watt neon tube.
1 Single-pole 12 position rotary switch.

RESISTORS.

1 5 meg.
1 1 meg. 1 per cent tolerance.
1 1 meg.
2 .5 meg.
1 .25 meg.
1 .05 meg.
1 .02 meg.
1 .01 meg 1 per cent tolerance.
1 4000 ohms.
2 2500 ohms wirewound potentiometers.
1 100 ohms 1 per cent tolerance.
2 10 ohms, 3-watt (optional).

CONDENSERS.

1 25 mfd. 40 peak volts electrolytic.
2 8 mfd. 525 volt working electrolytics.
2 .5 mfd. 600 volt tubular.
2 .1 mfd.
1 .01 mfd. mica 10 per cent tolerance.
1 100 pf mica or silvered-mica $2\frac{1}{2}$ per cent tolerance.

SUNDRIES.

6 terminals (2 Shock-proof type), 2 "magic eye" escutcheon plates, 1 large instrument knob, 2 small instrument knobs, 1 "magic eye" socket with cover, 4 tag strips, 2 octal sockets, heavy gauge tinned copper wire, spaghetti, metal for end brackets and 6U5/6G5 support clip, carrying handle and rubber feet for case, hook-up wire, nuts and bolts, &c.

9 x 7 $\frac{1}{4}$ Front Panel

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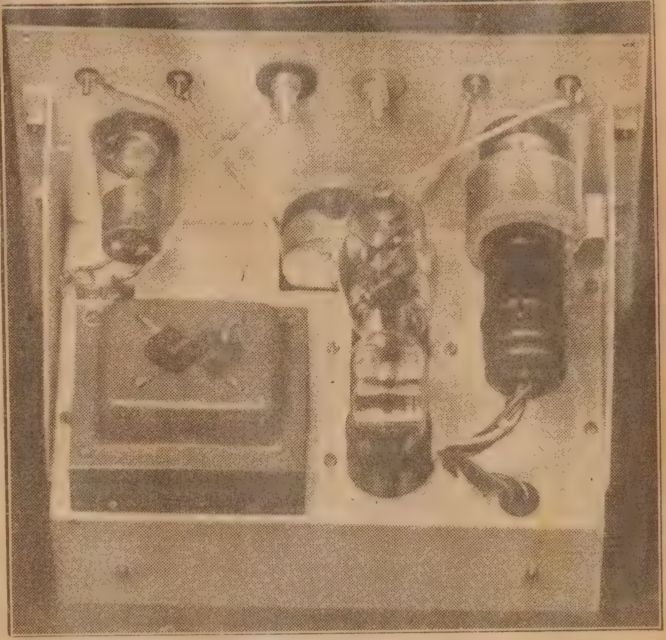
REAR VIEW OF THE BRIDGE



This rear view shows how above, chassis components are mounted.

circuit provides a d-c return path. The value of this resistor is a compromise between grid circuit time constant, particularly when on the high capacitance range and minimum loading on the bridge circuit. It is advisable when the range switch is in the high capacitance position, to rotate the dial slowly when looking for the null point.

The input to the voltage amplifier is the potential difference existing between two of the junctions of the four arms of the bridge. This potential difference will vary as the control is varied over its range, and it drops to zero when the bridge is in a state of balance.

The output of the voltage amplifier is fed into its own diode plates through a fairly large coupling capacitor, remembering that the voltage being amplified is at a frequency of 50 cycles. The parallel diode plates rectify this voltage, and it appears at the top of the .5 megohm diode load resistor as a negative potential.

INDICATOR OPERATION

Before this potential is fed to the control grid of the triode portion of the indicating tube, the 50 cycle ripple is filtered out by the second .5 megohm resistor and the .1 mfd capacitor.

The indicator tube operates in the following manner: When the grid receives no signal or bias, as when the bridge is balanced, plate current flowing in the triode portion causes the voltage appearing at the plate to drop to a certain level. An extension from this plate is in the electron path between the cathode and the target anode.

Under these conditions, the triode plate is negative with respect to the target anode and the electron stream is repelled from portion of the screen, leaving that portion in shadow for an angle of approximately 90 degrees. Different values of negative bias, or in this case, signal, on the control grid produce different angles of shadow and a certain voltage will close the "eye" completely.

The 6U5/6G5 closes with minus 22 volts applied to the control grid, when operated from a 250-volt supply. The "EM" series close with minus 5 volts for the EM1 and up to minus 21 volts for the EM3, for 250-volt operation.

As far as the bridge standards are concerned, the resistance values can be ordered to a tolerance of one per cent. In the interests of stability over a long period of time, the 1 megohm standard can be made up of four .25 megohm low tolerance resistors connected in series.

GOOD QUALITY

The 100 pf standard should be a good quality mica type and preferably of the silvered-mica type. It should be possible to obtain this value to a tolerance of plus or minus 2½ per cent. The .01 mfd standard should be of the mica type also and to the lowest available tolerance.

The 1 mfd standard will, in most cases, need to be made up by connecting two .5 mfd capacitors in parallel. Paper type capacitors usually have a tolerance of 20 per cent., so the idea is to obtain one of the .5 mfd with a plus tolerance and the other with a minus tolerance of approximately the same amount. This is not of extreme importance, however, as measurement of large values of capacitance is not normally required to be to a great degree of accuracy.

AVOIDING SHORT CIRCUIT

When using the bridge for the measurement of resistance, the heaviest load which can be imposed on the bridge supply source is when there is a short circuit across the measuring terminals, while the range switch is on the 100 ohm range. Under these conditions, 50 mA is passed by the 100 ohm standard, but the power dissipated in the resistor is only a quarter of a watt.

It is a different story, however, when using the measuring and the matching terminals for the measurement or matching of inductances or components having low d-c resistance. To prevent a virtual short circuit of the bridge supply source, it is necessary to insert series dropping resistors so that on the heaviest load the maximum current drain is reduced to safe limits.

These resistors are placed in each side of the supply to maintain capacitive symmetry of the bridge arms. The resistor values, while shown as being of 10 ohms, are quite flexible in that any values between 5 ohms and 20 ohms may be used.

This use of the bridge has its limitations as you can see. The current through the inductance or low resistance components being matched must be in keeping with their current carrying capabilities. Furthermore, the greater the current drain the lower is the effective voltage appearing across the bridge.

Possibly, a lower limit with inductance will be 5 to 10 millihenries.

You will note that a power factor control is connected in series with the standard for the high capacitance range. With this control an equal amount of resistance can be introduced into that arm of the bridge to compensate for any leakage resistance which may be present in the unknown capacitor being measured.

This condition is indicated when the null point is quite sharp, without any trace of fuzziness. Adjustment of the power factor control will call for a slight readjustment of the ratio control until the desired condition is obtained.

CALIBRATION

The calibration of this control in terms of percentage power factor is on the assumption that the standard capacitor on this range has negligible leakage resistance. For this reason, it is advisable to use the 600-volt working type of .5 mfd as standards.

The power factor control is not in circuit on the ranges where the standards are of the mica type, as the loss resistance in this type is usually so small in comparison with the reactance as to be negligible.

The calibration of this control is

XMAS
GREETINGS

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FROM OUR FRIENDS—

We get a lot of encouragement from some of the letters our customers send us—encouragement that stimulates us to keep on giving the very best service we can. For instance, Mr. J. McD., of Hamley Bridge, South Aust., writes a very nice letter and puts it in an envelope addressed to:—

Collins Radio
(The Dependable Firm),
Melbourne.

Then Mr. L.J.E., of Mt. Burr, S.A., says in a letter enclosing a remittance:—

> *"Here let me compliment you on your Mail Order Service which is surely—as you advertise—the fastest in Australia. My letter left here Tuesday morning and the parcel arrived here Saturday morning, which is a glowing example of speed."*

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For the music lover who wants to get original performance from his records. Wide frequency range, and free from the need for bass compensation noted with some other types.

ACOS, GP—10: Adjustable needle pressure—normal 1¼ oz. at the needle tip. With template **48/6**

COSMOCORD, GP—5: Large crystal enclosed in air-tight chamber, special anti-vibration arm bearing; exquisite [illegible] . . **67/11**

FERROCART: Curved arm, offset needle head, maximum fidelity, needle tip pressure, approx. 1 oz., with template, **49/6**

The technician will be interested to read the chemical formula of the crystal known as Rochelle Salt, or Sodium Potassium Tartrate, it is expressed thus COONa CHOH)2 COOK, 4H20. So now we all know!

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6 x 4 x 2	Open Ends	3/6
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Battery Terminal Paste	1/3
Dial Cord, best qual., yard	4d.
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Chassis to suit, extra	7/6
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Moulded Mica filled	1/1
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Polystyrene Aerial Insulators	6d.
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1/8" gross	1/6
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5¾" " "	4/6
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Stocks are Limited on some of these Special Lines—Order NOW to avoid disappointment. All goods are carefully checked with your order, and packed with equal care. Send stamped (2½d.) self-addressed envelope for Free Circuits and inclusion on our Mailing List. When remitting, please include enough to cover cost of postage or freight. Any surplus will be placed to your credit.

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Metal	6d.
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40 mA, 210/210	30/6
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60 mA, 295/295	32/7
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80 mA, 300/300	37/-
100 mA, 385/385	46/-
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150 mA, 400/400	68/10
200 mA, 450/450	84/10
250 mA, 500/500	110/2

COLLINS RADIO

for Mail Orders with Safe Swift Service
409 Lonsdale Street, Melbourne, C.1.

quite simple and can be achieved by applying the formula:

$$PF = \frac{2\ \text{pi}\ fCR}{10{,}000}\ \text{per cent}$$

where pi = 3.14 approx.

f = frequency in cycles per second

C = capacitance in mfd.

R = series resistance in ohms.

Thus, taking 2 pi as 6.28, f as 50 and C as 1 mfd, we can calculate the percentage power factor for various positions of the potentiometer to be used. We used a 2500 ohm wire-wound potentiometer so that the centre position of 1250 ohms represents a power factor of just on 40 per cent. The maximum resistance will represent 80 per cent. The intermediate positions are then marked in appropriate steps.

A 2000 ohm potentiometer would indicate about 60 per cent at full scale, 30 per cent at half scale, and so on.

OVER 1 MFD.

Note that this percentage is for 1 mfd. For values of capacitors above or below this, the percentage power factor as read on that control should be multiplied by the reading on the ratio dial.

This control will show a high reading for electrolytic capacitors in which the dielectric film has not been formed. This is usually the case when such a capacitor has not been used for some time. Once the capacitor has been placed into service and the film formed, the reading of this control will give an idea of the general condition of the capacitor.

Readers may remember, however, a piece of equipment described recently in R & H with which the general condition of capacitors may be observed more accurately. This was the Capacitor Leakage Tester described in the June, 1948, issue.

The theory of the operation of the bridge is quite simple in that the ratio between the standard and the unknown is duplicated by the resistances between each side and the moving contact of the ratio control. This condition is present when the bridge is observed to be at balance; that is, when the indicating "eye" is fully open.

DIRECT READING

Thus by calibrating the ratio control dial in terms of ratio of the resistance on one side of the moving contact to the resistance on the other side of the moving contact, the value of the unknown component can be read directly after observing the range on which the bridge is set.

The use of an a-c source of supply to the bridge permits the measurement of capacitance by reading on the dial the ratio of the reactances. Because reactance of a capacitor is inversely proportional to the value of capacitance, the capacitance scale on the ratio dial must read in the reverse direction to the resistance scale.

Up to a certain degree of accuracy, the two scales can bear a reciprocal relationship. For instance, where, say, 2 is read on the resistance scale,

(Continued on Page 55)

FROM A "MATCH BOX" RADIO
TO A LARGE CONTROL PANEL

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IRC METALLIZED RESISTORS • include Types BT, F, MP and MV. They are small, compact Resistors with lower operating temperatures and higher wattage dissipations than was formerly obtainable with respect to size.

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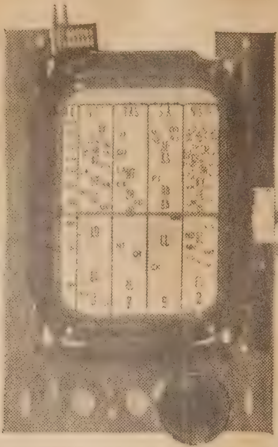

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The latest Efco release is the SLV/21 straight line dial. This unit represents the most modern trend in radio dials. Its dimensions are $6\frac{3}{8}$" x $4\frac{3}{8}$" with Escutcheon opening $3\frac{1}{2}$" x $2\frac{1}{2}$". Condenser calibration is H & AWA while the scale glass is in two colours.

Ask your local dealer.

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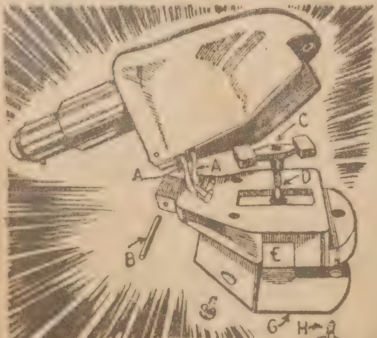
Sensational new Decca pick-up

revolutionises reproduction

Full frequency range recording is here!



Pick-up exploded A—leads from coil B—hinge pin; C—rubber mount for armature; D—the armature; E—magnet; G—cover plate.

Only this pick-up, in combination with precision transformers and a high-fidelity speaker, can do justice to the magnificent new full frequency range recordings now available. The pick-up has no resonance below 14,000 cycles, and surface noise is infinitesimal. It's the pick-up Decca specially developed to handle their ffr recordings. Goodman Speakers and Redline transformers enable you to obtain the full benefit of this marvellous pick-up.

• For further information write, phone, or call at "The Helpful Wholesalers" to-day.

Technical data

Size of body . . .

Length $1\frac{3}{8}$". Diameter $1\frac{1}{8}$". Depth $\frac{5}{8}$".

Weight of head, $\frac{1}{2}$ oz.

Frequency range . . . up to 14,000 cycles.

Armature tip . . sapphire.

Impedance at 1000 cycles . . . 30 ohms.

Output 1000 CPS . . . 11 mV.

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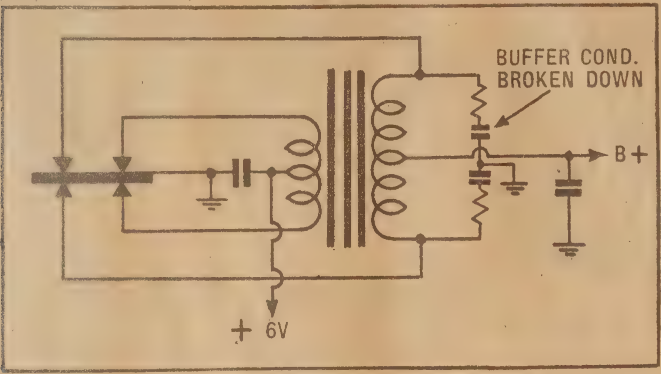
85/HP.4

FROM THE SERVICEMAN WHO TELLS

Two or three months ago I said that I had no desire to share the experiences of country servicemen—dusty roads, broken springs, flat accumulators and all the rest of it. While my location has not changed in the meantime, I have come up against a couple of jobs which must be everyday items for my rural confreres.

THE first one concerned a vibrator mantel set which spent its time alternatively in the owner's boudoir and his very nice four-berth caravan. (Yes, I like caravans.)



A likely cause of failure in a vibrator set is breakdown of a buffer condenser. Subsequent overload can reduce the life of the vibrator cartridge, due to burning of the contacts.

I found that the receiver was still operating but in very poor fashion, and my first reaction was that the vibrator cartridge must require replacement. However, the set-owner had already thought of that, but assured me that a new vibrator did not improve matters.

Being by nature a rather difficult individual I nevertheless insisted in trying out the new vibrator, noting the noise which the two cartridges made. In both cases the noise was very rough in character and much louder than usual.

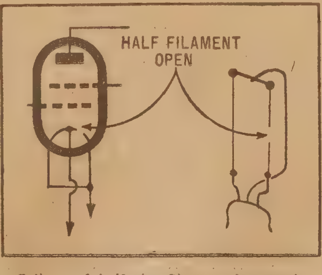
When a vibrator is running properly only a soft and perfectly even hum can be heard, unless there is some mechanical vibration in the socket or the vibrator itself is touching another component. Old vibrators tend to become more noisy in their operation, due to partial failure of the rubber packing and to pitting of the contacts, which gives an uneven drive to the reed.

BUFFER CONDENSER

Since neither circumstance could be blamed in this case my next reaction was to blame a "buffer" condenser, and this assumption ultimately proved to be correct. The unfortunate aspect of the matter was that a certain amount of dismantling had to be done before one could get anywhere near the offending component.

Examination of the receiver showed that a buffer condenser was connected to each end of the high tension secondary winding, with a 100-ohm series resistor. In this case the short circuiting of the buffer condenser meant that the small 100-ohm resistor was across half the secondary, forming a heavy load on the circuit and becoming gradually a charred mass as a result. Had the resistor not been in place the broken-down condenser would have formed a complete short circuit across the transformer secondary, resulting in a damaged transformer, a ruined vibrator, or simply a blown fuse—whichever circumstance came about first.

I must confess that my experience with vibrator equipment is fairly limited, but I have seen more than once on the screen of a CR oscillagraph the peak voltages which are produced at the secondary of a vibrator transformer. Not only must buffer condensers be of the correct value to tune the secondary but they have to be able to withstand a much higher potential than is immediately evident on a volt meter.



Failure of half the filament in certain valves is a "trap for young players." Ohmmeter still shows continuity although the performance is seriously affected.

At any rate the supply was duly reassembled, after which the receiver proceeded to work with gay abandon, and with either vibrator in place. Unfortunately this client is using his caravan at the time when my holidays are normally due!

My second "taste" of battery receiver problems came in the form of a personal portable which was afflicted with limited power output.

As I "unpacked" the tiny chassis from its equally tiny cabinet I began to wonder whether or not, after all, the lot of a country serviceman may not be the best one. With more and more personal portables appearing on the beaches we are likely to have a fairly frequent need for our tweezers and eyeglass.

BATTERY CHECK

A check on the batteries revealed that the voltages were okay, but the receiver should have made somewhat more noise than was apparent. Even at their best, of course, these personal portables have quite limited output, and any attempt to turn up the volume so that a set can be heard more than a few yards away will produce severe distortion.

Next step was to check the valves and the output tube—one of the new 2.8 volt type—showed a low figure of merit. The quality readings obtained from these miniature battery valves tend to vary considerably, in any case, but there seemed no doubt that this one was well down.

Suspecting what might be the trouble, I checked the filament pins and found that half the filament was open-circuited, the remaining section of the filament, however, giving enough emission for the valve to carry on.

METER CHECK

When valves like the 3S4 and 3V4 come into wider use we can expect this trouble to recur frequently, and I can see that one of our routine checks will be to test each half of the filament with a multimeter. By the way, do not attempt to make this test with the meter set to the lowest ohms range as, in some cases, the current through the filament may exceed 50 milliamps.

I can recall some trouble of a similar nature with the 1D8-GT. In this case the common complaint was for the filament of either the triode or the pentode section to open up, leaving the other section intact. The filament would test okay on a meter, of course, but the valve would not operate.

Another case I can recall involved a 19 or 1J6-G — I forget which — in which one filament had opened up, leaving the set with what amounted to a single-sided Class B output system.

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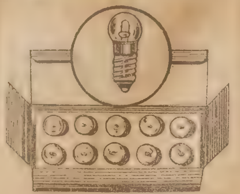

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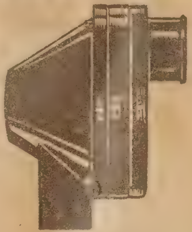

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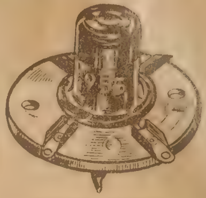

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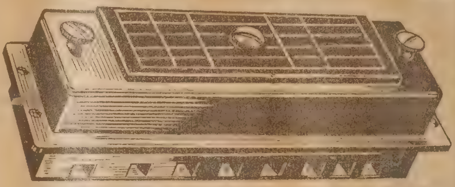

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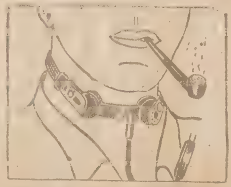

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New, contain excellent generator and brass gears. In aluminium case.. Weight 13lb.
EACH FOR **29/6**

METAL CLAD SUPPRESSOR CONDENSERS
for noise elimination in Cars, Motors, and all Electrical interference. With mounting lug and wire.
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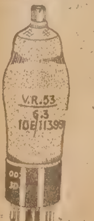

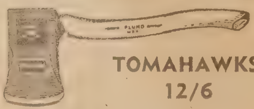

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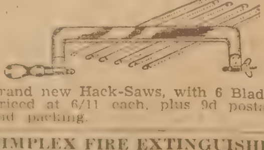

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Auto Type with mounting bracket. Fully charged. New.
Postage 2/6 EACH **25/-**

New Woollen ½ hose, Black, sizes 10½ and 11 inches, 3/9 per pair. 6d post. New Woollen Ribbed Stockings. Sizes 10½ and 11½ inches, 4/11 pair. Strong White Cotton Webbing, 1½ inches wide, 2d per yd. Coil of 50 yards, 8/-. Postage 1/-.

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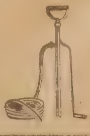

BRAND NEW STIRRUP PUMPS
American made, with 15ft. of Hose.
5/6
Freight N.S.W. 2/6
Interstate 3/6.

NO C.O.D.

RADIO MART

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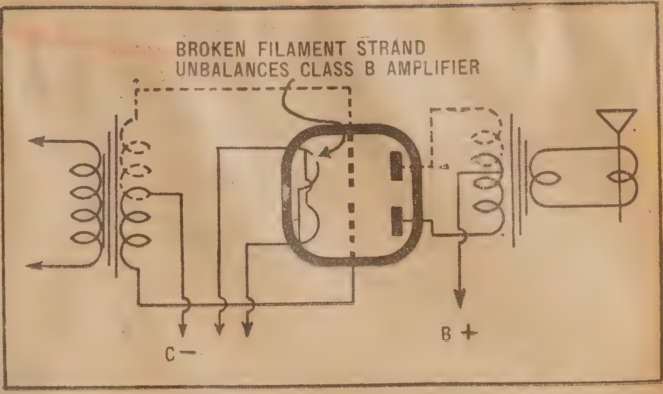
SYDNEY, N.S.W. MA2351

Oh, well, such is life!

By way of a change, let's look at a couple of letters and profit by the experience of other servicemen. A reader from New Plymouth, New Zealand, says:—

"I came across a rather tricky fault in a '——' receiver that I thought might be interesting. The particular model had a couple of high capacitance electrolytics in the filter, and used back-bias.

"One evening, apparently, the receiver set up an intolerable hum (not an exaggeration). I removed the chassis from the cabinet and began to poke around among the resistors to see if I could find what was wrong. Since the hum had started quite abruptly, the electrolytics could hardly be blamed, for they lose capacitance gradually.



What happens in a class B amplifier when half the filament fails. With the 1D8-GT, failure of either section of the filament prevents the receiver operating.

LEAKING CONDENSER

"I noted that the hum could be made to disappear by pressing on one of the electrolytics, and careful examination revealed that the component was leaking a thick 'goo' which was apparently shorting between the chassis and back-bias circuit. The cure was obvious."

I must thank this reader for his letter and, while I have never actually come across a short circuit due to a leaking electrolytic, the effects of a shorted bias network are not unknown.

Back around 1934 back-bias circuits were used quite a lot, and receivers had two or three can-type electrolytics. The first electrolytic, and sometimes the second, therefore, had to be insulated from chassis by a couple of fibre washers, and not infrequently a short would develop between a can and the chassis. The result would be zero bias on the output valve, heavy current through the filter, a persistent hum and distorted signals. If nothing else, the current tubular type electrolytics save us from juggling with pernickity fibre washers which could never be made to do the right thing

Another letter comes from a reader in Taralga, NSW:—

"Recently a receiver was brought in that would drop out of oscillation shortly after being switched on. I changed the 6A8-G for a new valve, but the behavior was exactly as before.

"Checking the osc. grid leak resistor and condenser, the valves were found to be within reasonable tolerance, so that I next broke all connections and re-soldered them to eliminate the possibility of a dry-point. The oscillator plate voltage was also increased, but this, too, failed to rectify the trouble. I next

(Continued on Page 47)

DEMAND CROWN

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DISCRIMINATOR TRANSFORMER
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Freq. 10.7 meg.
Cap. 50 mmf.
Wound and tropic treated same as PT44.

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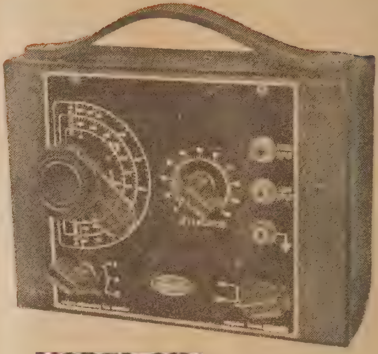
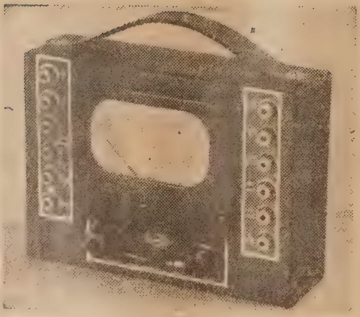


MODEL OK1

OSCILLATOR KIT

For years of active service, yet simple to build at home with a few ordinary tools! The "University" OK1 Oscillator Kit covers all fundamental frequencies in the average receiver—the dial is specially calibrated. Standard batteries are used and each OK1 Kit is complete with instruction book giving pictures and wiring diagrams and all parts.

PRICE £8 (plus tax).



MODEL MK1

MULTIMETER KIT

The "University" Model MK1 is an AC-DC Multimeter Kit you can build yourself. Handy companion to the OK1 and the same neat size—6ins. x 8ins. x 2½ ins. Uses popular 4 ins. square type meter with clear multi scale. All wiring instructions and constructional details are given with the kit and photographs and circuit diagrams make assembly simple. All parts are prefabricated so that fitting is simple.

PRICE £8 (plus sales tax).

★ BACK AGAIN--THE PK4X 4-VALVE PORTABLE KIT

The new PK4X Portable is a greatly improved radio incorporating all the latest technical advances. The kit set includes bantam type valves and Mini-max batteries. Genuine, leather covered carrying case is provided, all parts (including 5" Alnico speaker), plans and illustrated instruction book are provided for easy assembly with a few simple tools.

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University

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From The Servicemen Who Tells

(Continued from Page 45)

dismantled the oscillator coil, in case corrosion was in evidence.

"The coil revealed no such trouble, so I reassembled same and set the receiver in operation, for it to behave exactly as before. My next step was to rebuild the circuits round a 6J8-G, and the set performed normally for several days.

"Curiosity getting the better of my judgment, I reverted to the original design for the receiver and substituted another 6A8-G, only to have it behave as in the first instance.

"In desperation, I put in yet another 6A8-G (the third in all) and the set has given its owner continued service since. The point in all this being the unreliability of a new valve, coincidentally two in this occasion, where operating conditions are critical."

If I may break in with a comment (who's writing this article, anyway?) I would say that any receiver which was so finicky about oscillator valves would definitely be of poor design. At the very least a new oscillator coil would be indicated.

In the days of the old 15 and 1A6 battery converters, it was a "touch and go" to maintain oscillation over the whole band, but there is no such problem in regard to a valve like the 6A8-G. In a case of emergency, where a replacement oscillator coil is not readily available, the oscillation could be introduced or increased by winding a few extra turns to the plate winding. But back to the letter.

BATTERY SET

"A battery set was received, which its owner said would sometimes operate at a whisper, but was at other times quite normal. Occasionally it stopped altogether. Setting same up on the test bench, and using a B eliminator, it performed 100 per cent without a trace of the said complaint, for over a week of trial.

"I returned the receiver to its owner but he brought it back within a few days. I therefore, asked them to bring the batteries in, even though I knew them to not be more than a fortnight old.

"Again I ran the set intermittently on its own batteries for over a week and, not being able to fault it, decided to deliver the set some distance out in the country and check up on its operation in the home.

"Installing the chassis temporarily in its cabinet it ran well enough for me to assume that I could bolt it down. However, switching the set off to make the installation I found that, when it was switched on again, it would not go.

"Pulling the power valve out to listen to the customary 'plop,' the speaker was dead so that I next proceeded to test the battery leads for intermittency and the batteries themselves for voltage—only to find no reading available.

"The trouble at last—an intermit-

(Continued on Page 83)

XMAS
GIFT SUGGESTIONS

MANTEL CABINET
Smartly finished Black Bakelite Mantel Cabinet, complete with dial and chassis. Designed to meet the needs of home radio builders. 39/6 ea.

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Ceramic Sockets. 5-pin to suit 807's. Price 2/- each. 18/- doz.

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70 MFD 150 volt. | 20 MFD 240 volt.
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The completed set makes quite an attractive picture in its new cabinet and with its fully calibrated dial.

A FULL SIZED PORTABLE

Here is a portable which has been designed "full size"—meant to give the same general reception as any other 5 valve set together with the much better reproduction allowed by the bigger speaker. It is a good, heavy duty job, and although not large, is in another class from the baby "Personal" types.

OUR presentation of this design does not in any way detract from the value of little sets like the "Multi-Talkie." They have — and always will have — their attraction for the teen-agers and the travellers, who like them for their cuteness and their small size.

But these features take away from their ultimate performance. It is necessary to use a miniature loudspeaker which, despite notable advances in technique, is still not able to produce a great deal of volume, when used in conjunction with miniature valves and miniature batteries. Acoustically, the larger units are more efficient, so that the signal from a baby portable sounds really loud when transferred to a larger and more effectively baffled speaker.

Appreciating these points, many readers have requested the design of a portable incorporating a larger speaker, and, at the same time, using batteries which exhibit longer life than the miniatures which have to be fitted to a personal portable.

USE OF RF STAGE

There is one other point which markedly affects the performance of a portable, and that is the inclusion or otherwise of an RF stage.

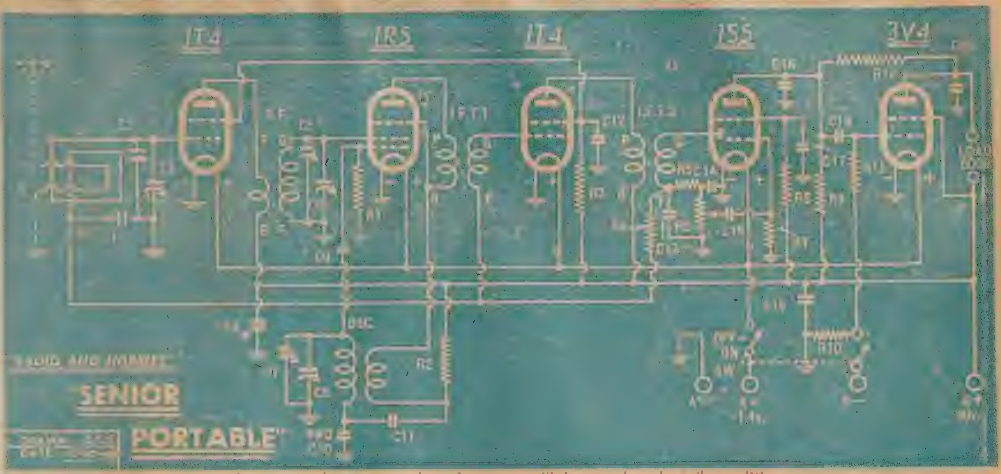
The signal pickup possible with a loop aerial is comparatively small, and, once a portable is taken outside the immediate service area of local stations, the set has to operate at near full gain to bring the signals up to listening level. Under those conditions, it generates a fair amount of carrier hiss, contributed mainly by the converter valve, which is inherently noisy, almost irrespective of its type.

With an RF stage, however, the incoming weak signal is amplified before it gets to the converter, and the overall signal-to-noise ratio is improved. The overall gain is improved also, and that is an equally important advantage.

Of course, extra components are required, and there is additional drain on the batteries, but none of these factors outweigh the advantages in a larger design.

The circuit, therefore, resolves itself into something very much akin

CIRCUIT DIAGRAM OF THE "SENIOR PORTABLE"



As the circuit shows, general performance will be good under all conditions.

to that of the "All-Battery Five," described in the September issue. A loop relaces the aerial coil and feeds into the grid of a 1T4, acting as an RF amlifier stage.

This is followed by a 1R5 converter valve operating in a perfectly conventional circuit for this type. Then follows a 1T4 IF amplifier, a 1S5 as detector and audio stage, and a 3V4 output valve.

As we have pointed out on other occasions, it is not advisable to operate all valves under maximum conditions, since the total current drain would amount to between 20 and 25 milliamps — enough to wreck portable batteries in a very short time. It is, therefore, necessary to effect some compromise to reduce the current drain of the high-frequency amplifiers and the output valve, without upsetting too much the overall performance of the set.

BATTERY DRAIN

The best approach to this depends on circumstances. If the set is to be used in suburban areas and plenty of undistorted power is required, the high-frequency amplifiers can be cut well back and the output valve operated at approximately its optimum bias. If, on the other hand, extreme range is desired, it is better to let the RF and IF amplifiers run "flat" and over-bias the 3V4.

Our own design follows the rather obvious course of limiting the drain in all stages by a small amount, so that it approximates 12.5 milliamps without signal and 11.5 milliamps with signal. Sensitivity is good and the power output ample for all normal requirements. In fact, the moment we switched this set on, we were impressed by the difference which the larger speaker and cabinet makes to the reproduction.

In most respects, the component values are similar to those specified for the "All-Battery Five," with one or two small amendments. We have dropped the screen resistor R3 to 20,000 ohms with the idea of increasing slightly the overall gain to counter the limitations of a loop aerial.

BIAS RESISTOR

Similarly, resistor R10 becomes 400 ohms, allowing the 3V4 output valve to operate under slightly better conditions. In the normal way, a portable cannot rely on room echoes, for reinforcement of the volume, as is the case with the normal domestic receiver.

The tone control has been eliminated also, since the physical layout allows only two knobs. You will note, instead, that we have used a small amount of negative feedback provided by resistor R12 connected between the two audio plates. This resistor makes a contribution to tonal quality at the expense of gain, but, in most cases, you will find that the gain is ample. In remote areas it may be preferable to omit R12 altogether, and we leave it to the individual constructor to make a decision on this point.

One other point of difference is that an 8 mfd high tension bypass replaces the condenser previously connected across the back bias resistor. The high tension bypass serves the same purpose in preventing degeneration through the resistor, but is also valuable when the batteries begin to develop high internal resistance.

To prevent the flow of leakage current through this bypass, we suggest the use of a double pole "off-on" switch with one section wired in

PARTS LIST

1 Chassis 12" x 5" x $1\frac{3}{4}$".
1 Small 3-gang (400 pf approx.).
1 Dial type SLV-21 with BC glass to suit gang.
2 Broadcast coils (RF, and Osc.).
1 Loop aerial.
2 455Kc IF transformers (No. 1 and No. 2 pos.).
5 Valve sockets; button-base type.
1 Octal socket.
1 Permag. speaker preferably 6" or 7" dia.
2 45-volt batteries.
1 $1\frac{1}{2}$-volt battery.

VALVES.

2 1T4, 1 1R5, 1 1S5, 1 3V4.

CONDENSERS.

C1 .05 mfd. tubular.
C2, C5, C7 gang trimmers.
C3, C6, C8 gang sections.
C4, C11, C12 .1 mfd. 200v tubular.
C9 .0001 mfd. mica.
C10 .000425 mfd. mica.
C13, C14, C16 .0001 mfd. mica.
C15, C17 .01 mfd. mica.
C18 8 mfd 350P.V. electrolytic.
C19 .001 mfd mica.
C20 .001 mfd mica.

RESISTORS.

R1 .1 megohm.
R2, R3 .02 megohm.
R4 2 megohm.
R5 .05 megohm.
R6 1.0 megohm pot with D.P. switch.
R7 10 megohm.
R8 3 megohm.
R9 1.0 megohm.
R10 400 ohm.
R11, R12 3 megohm.

SUNDRIES.

2 Terminals, approx. 12" shielded cable, 1 octal plug, hook-up wire for battery and speaker leads, two knobs, solder lugs, nuts and bolts, &c.

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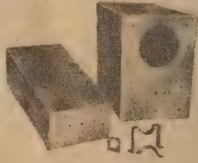

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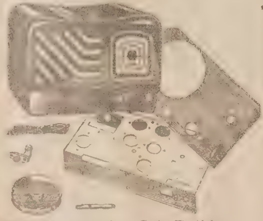

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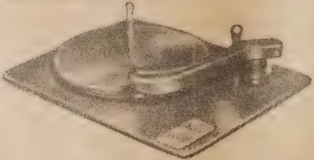

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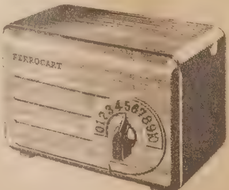

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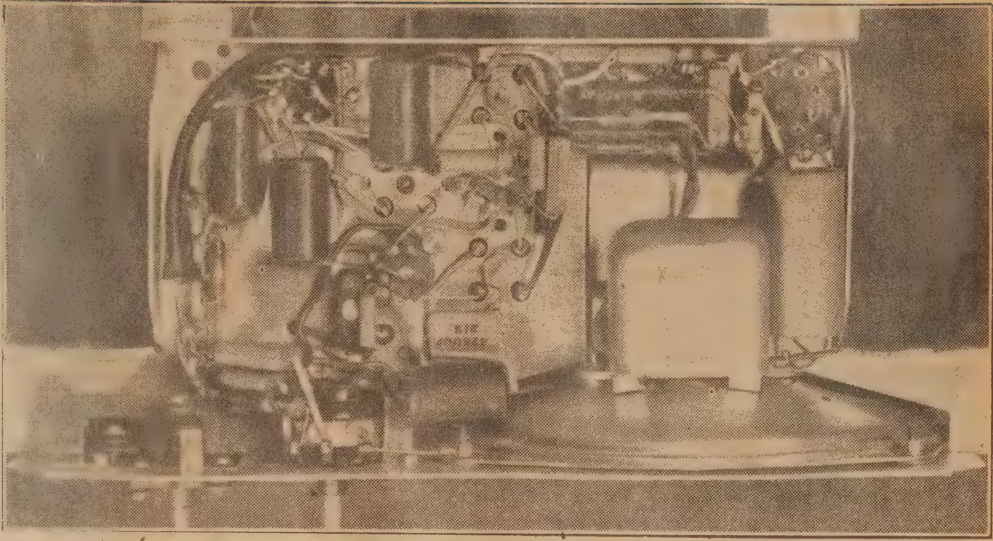
UNDERCHASSIS VIEW OF THE NEW PORTABLE SET



There is much more room under the chassis, which is rather unconventional in its shape.

the A-plus lead and the other in the B-minus lead. Just at the moment, only single pole switches are available attached to volume controls, but we understand that the double pole variety is to be made available in the very near future. Actually, the leakage current referred to will not amount to much and can be eliminated for the time being by unplugging one of the B-batteries when the set is stored away for any lengthy period.

PHYSICAL SIZE

As with most portables, the chief problems are concerned with physical construction. For reasons already outlined, it was desired to use a fairly large loudspeaker, and the chassis, therefore, had to accommodate either a 6in. or a 7in. type.

Just in passing, we must stress the importance of obtaining a modern speaker with high magnetic flux. The difference between a sensitive loudspeaker and one intended for general use can amount to several decibels in level, which is equivalent to doubling the effective power output of the receiver.

The smallest conventional dial available at the moment is the SLV/21, so that the side-by-side arrangement of the dial and speaker sets the limit to overall height and overall length. The width of the cabinet is governed largely by the batteries, which have to pack in behind the thickness of the dial assembly and speaker housing.

The inside dimensions of the cabinet, therefore, become 6in. wide, 7 5-8in. high, x 11¾in long. Allowing for the thickness of the timber, this is still a more handy size than the prewar-portables, despite the fact that we have managed to pack in vernier dial and a much larger and more efficient loudspeaker.

Looking at the layout of the chassis the speaker mounts in a cutout on the left-hand side, with the output transformer, still attached, protruding down through the chassis. It may be necessary, in special cases, to modify the shape of the cut out slightly with a file, but this is no great hardship.

The dial bolts directly to the face of the chassis, and overlaps the edge of the speaker by about ¾in. This means, of course, that the speaker will be set back from the face of the cabinet, but the gap can be filled quite conveniently by mounting a suitably shaped baffle behind the speaker fret, sufficiently wide to fill the gap between the cone edge at the front of the cabinet.

The B-batteries stand upright, one at either end of the chassis, with the A-battery lying across the top. This arrangement necessitates a special cut out at each end of the chassis, and this will be seen in the photographs. In the original chassis, which was hand-made from sheet aluminium, the edges of the cut out were bent down to prevent any possible chaffing of the battery carton, but chassis manufacturers may elect to follow the simpler course and leave a plain cut out of the appropriate dimensions.

WITH comparative simple alterations, this set can be made to operate with an A.C. power supply. Next month, we hope to tell you how this may be done. We are also working on a larger loop aerial which will allow better pickup—a help when signals are on the weak side.

CABINET HEIGHT

The little lip at each end of the chassis slides in sawcuts inside the ends of the cabinet. This arrangement holds the front of the chassis firm but it, too, is an optional refinement.

The height of the cabinet is slightly greater than necessary to accommodate the speaker and batteries and behind this dimension is provision for an idea which we have in mind.

Many current American portables operate with their filaments connected permanently in series—an arrangement which lends itself very conveniently for power mains operation.

There is no reason why this present circuit should not be modified along these lines, the filaments operating for example, from three series-connected cycle batteries.

A number of these batteries can be fitted into the space at the top of the cabinet and the additional "head room" will allow a plywood shelf to be installed.

In actual fact, we seriously considered adopting this arrangement as standard but realised that some readers may be discouraged by the additional complication of the filament circuit. This first and standard version of the "Senior Portable" therefore uses the straight-forward arrangement and a 1.5 volt filament battery.

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OVER A WIDE RANGE

WITH THE

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Model 512 A.C.-operated Model 512 B. Battery-operated (with internal batteries and provision for external batteries).

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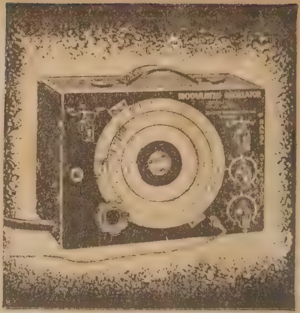

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The layout of the remaining components on the chassis follows a logical sequence and it will be noted that we have left space behind the gang condenser for the use of an aerial coil, should it be required in special circumstances.

Actually, the characteristics of a modern loop are very good and there is not a great deal to be gained by substituting an aerial coil for use with an outdoor aerial. Equivalent results will be obtained by feeding the same aerial (and earth) to the appropriate tappings on the loop.

At the other end of the chassis is a plug to receive the battery supply and this will be of obvious value later, if and when a universal version of the set is described.

In view of current trends, provision of a-c as well as battery supply will be essential to meet the wishes of many readers.

SHIELD CANS

It will be noted that special shield cans are fitted over the converter and IF amplifier valves. These will not be necessary in most cases but they may prove handy if there is any tendency for the IF channel to oscillate. The particular cans include a spring which holds the valve firmly in its socket and this is an attractive feature quite apart from the electrical shielding afforded. Where expense is no object, the receiver will acquire a much more rugged appearance if these shields are installed over all five of the valves.

Last, but not least, comes the important point of where to mount the loop aerial, because signal pickup improves considerably if the loop can be mounted clear of the batteries and chassis.

In this receiver, the batteries and chassis are enclosed by a false back which screws into position inside the rear of the cabinet and leaves a space of approximately ¼in. between the false back and the outside lid. The loop aerial itself is mounted on the inside of the lid, connections being made to the receiver either by flexible lead or by using the two hinges at the top as the means of connection.

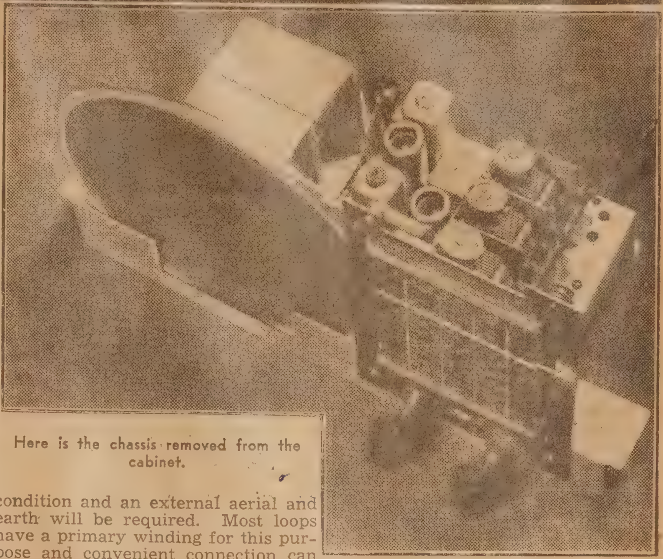
LOOP OPERATION

Where space is restricted or in areas close to the broadcast stations, the set can be operated with the lid closed and the loop therefore located fairly close to the batteries and chassis. Under these conditions, it will, of course, operate quite well and show an improvement on the ordinary miniature receiver which has no RF stage.

In more remote areas, where the loop is not operating to advantage, the lid can simply be opened up and held vertically, putting the loop absolutely in the clear and several inches above the receiver. If it is pointed edge-on to the station at the same time, the signal pickup will be improved.

Ultimately, of course, the signal strength may diminish to a point where it is too low even for this condition and an external aerial and earth will be required. Most loops have a primary winding for this purpose and convenient connection can be made by mounting a small terminal or pin jack at each end of the carrying handle, connecting them respectively to the aerial and earth lugs on the loop.

GENERAL VIEW OF THE CHASSIS



Here is the chassis removed from the cabinet.

We may have more to say in a future issue about possible arrangements for the loop aerial and also modifications to the rear lid to make the best of tonal quality.

At this stage, it appears desirable to arrange a fret in the false back to relieve back pressure on the speaker when the rear lid is opened. Apart from improving the tonal quality, this also has the advantage of allowing people seated behind the cabinet to hear the programme reasonably well.

The receiver has been in operation only a few days, at the time of writing, but we are more keen about it than ever. The set is easy to carry, easy to tune and, above all, easy to listen to. Several trade identities who have seen the set and heard it play, say it is just what the home builder has been waiting for.

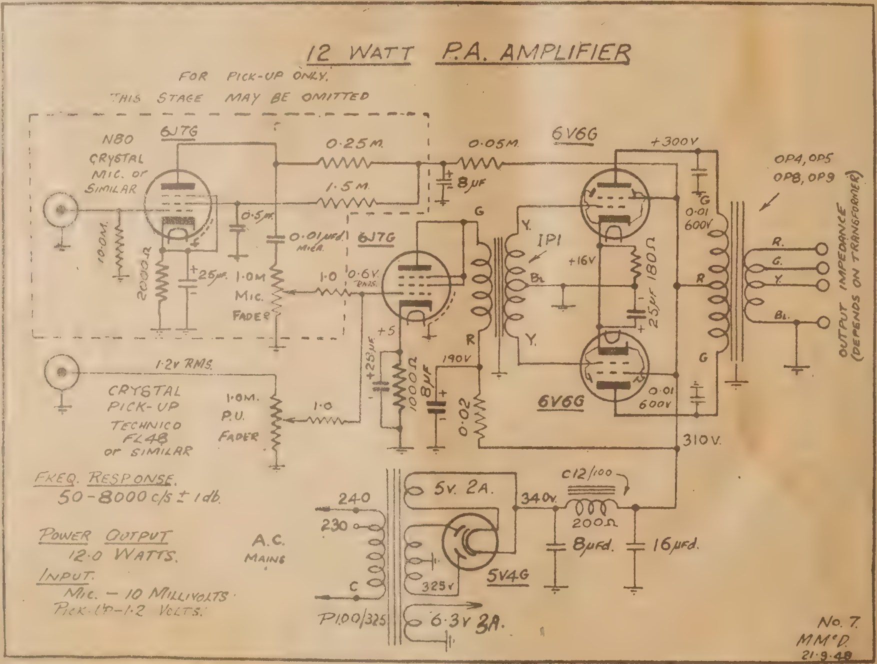
You'll hear more about the "Senior Portable." As we said earlier, we have already envisaged amendments which will increase its appeal and its application. But, in the meantime, if you want a portable for Christmas, you can build the straight version with the assurance that none of the components you buy will be wasted.

This rear view shows clearly the cut-outs which accommodate the B-batteries and the two lips which slide in sawcuts at each end of the cabinet. Valve shields can be fitted over the three valves at the rear for physical protection.

FERGUSON'S RADIO PTY. LTD.

12 WATT PUBLIC ADDRESS AMPLIFIERS

From time to time we receive enquiries regarding the design of Amplifiers intended for such uses as Public Address Work, Home Listening, High Fidelity Recording, etc., and we feel that there are many who would like to share the results of these queries.
We present as number one in a series of Amplifier designs, the circuit of a low power Public Address Amplifier suitable for the average size hall or public meeting.
The design follows modern practice with a minimum of parts necessary to suit the design requirements.
It is generally agreed that a power output of 10-15 Watts is necessary to accommodate the average size hall with the output being divided by two or three 12" cone type speakers in the case of a dance hall or, say two 8" cone type speakers with flares for the outdoor function.
Two type 6V6G tubes operated Class AB1 with a supply voltage around 300 volts will satisfy the power requirements.
Grid drive for these tubes can be best derived by using an interstage transformer since it provides a push pull drive with a stage gain and allows the full gain of the driver tube to be realised.
A low D.C. grid resistance is also advantageous in obtaining slightly greater power output.
Two input channels have been provided, one for a crystal microphone, the other for a crystal pick-up, with a suitable mixing arrangement that exhibits negligible interaction.
Crystal type units have been chosen from the economical point of view, they exhibit the highest output for a given response—thus reducing the tube line up.
Should it be desired to use the Pick-Up only, the microphone pre-amplifier stage can be omitted as shown by the dotted line.
For Portable P.A. work the A.C. power supply shown could be replaced by a 300V. 100 M.A. genemotor operating from a 6V. car accumulator.


12 WATT P.A. AMPLIFIER
FOR PICK-UP ONLY.
THIS STAGE MAY BE OMITTED
N80 CRYSTAL MIC. OR SIMILAR
6J7G
0·25M.
1·5M.
0·05M.
6V6G
+300V
8μF
0·5μF
10·0M.
2000Ω
25μF
0·01μFd MICA.
1·0M MIC. FADER
1·0
0·6V RMS.
6J7G
G
IP1
Y.
BL
+16V
180Ω
25μF
R
Y.
0·01 600V
OP4, OP5 OP8, OP9
R.
G.
Y.
BL.
OUTPUT IMPEDANCE (DEPENDS ON TRANSFORMER)
+5
25μF
1000Ω
8μF
190V
0·02
6V6G
1·2V RMS.
CRYSTAL PICK-UP TECHNICO FL48 OR SIMILAR
1·0M. P.U. FADER
1·0
310V.
FREQ. RESPONSE. 50-8000 c/s ± 1db.
POWER OUTPUT 12·0 WATTS.
INPUT. MIC. — 10 MILLIVOLTS PICK-UP—1·2 VOLTS.
240
230
C
A.C. MAINS
5V. 2A.
5V4G
325V
P100/325
6·3V 3A.
340V.
C12/100
200Ω
8μFd.
16μFd.
No. 7.
MM'D.
21·9·48

RECOMMENDED STANDARD RANGE TYPE

TYPE	REMARKS	TYPE	REMARKS
Output Transformer		Interstate Transformer 1P1	Single 6J7G Triode, 5 M.A. D.C. Push Pull grids.
OP4 or OP5	Suitable for single speaker operation. 12.5 ohms, 8.0 ohms, 2.3 ohms voice coil.	Power Transformer P100/325	Prim.—240/230 50 s/c. H.T. Sec—325/325—100 M.A. L.T. Sec—2 x 6.3v at 2 Amps. L.T. Sec—1 x 5.0v at 2 Amps.
OP8 or OP9	Suitable for remote speakers. 500 ohms, 250 ohms, 125 ohms.	FILTER CHOKE C12/100	12 Henries at 100 M.A. D.C. +50v A.C. 100 c/s.

Procurable from any wholesale house in all State including Tasmania. If you have any trouble obtaining supplies, write to us direct and we will forward a list of suppliers.

FERGUSON'S RADIO PTY. LTD.
15 McMAHON ST., WILLOUGHBY, N.S.W. PHONE: JA6177, JA2877

FACTORY REPRESENTATIVE:

N.S.W.: ELECTRONIC INDUSTRIES IMPORTS.
VIC.: ELECTRONIC INDUSTRIES IMPORTS.
QLD.: ELECTRONIC INDUSTRIES IMPORTS.
STH. AUS.: APEX AGENCIES.

An R.C. Bridge

(Continued from Page 41)

the capacitance scale will show .5, and so on. But more about this anon.

The unit was constructed on a chassis measuring 8in. by 5¼in. by 2¼in. This chassis is attached to a front panel measuring 9 1-8in. by 6 5-8in. Side brackets are employed to stiffen the whole assembly and to provide an easy method of attachment of the simple clip supporting the indicating tube.

The complete unit fitted into a crackle-finished metal instrument case, which happened to be available.

The layout of the front panel is evident from the photographs. The layout was arranged to form a symmetrical pattern as well as to provide for reasonably neat wiring of the bridge circuit.

TERMINALS

At the upper left of the front panel are the terminals for the unknown component. The terminals at the upper right are for the external standard when desired, while those in the centre are for use of the neon leakage indicator, mounted on the right-hand side of the panel.

Balancing this on the left hand side of the panel is the electron ray indicator tube, below which is the range switch. The percentage power factor control is at the lower right, and the ratio control is, of course, in the centre. The shaft of the power factor control is insulated from the front panel.

The three contact lugs on the ratio control protrude through a cut-out in the chassis to simplify the wiring of the bridge circuit and to keep capacitances to earth of the bridge arms at a minimum. The bridge circuit itself is wired with spaghetti-covered heavy gauge tinned copper such as 16 s.w.g. This wiring should be kept away from the chassis and arranged so that it remains rigid.

If the range switch were increased to a two gang type, it would be possible to arrange the switching of the standards so that the one scale on the ratio control would serve for both resistance and capacitance. This extra switching would be such as change the standards and the unknown into opposite arms of the bridge when changing from resistance measurement to capacitance measurement.

CALIBRATION

Calibration takes the form of placing known values of resistance across the terminals marked 'Res & Cap' and marking their ratio with the standard on the scale card under the knob pointer when the bridge is brought into balance. As the ranges are in decimal relationship, it is necessary to calibrate the ratio dial scale for one range only.

The simplest method is to obtain low tolerance resistors with values in decimal relationship to the standard. Considering that the calibration is being carried out on the 100 ohm range, suitable values of resistors would be a 5 ohm, 2 each of

R5

Smooth Silent
RECORDING

and the
RECORD...

To achieve smooth, silent recording, the coating on the recording blank must have a regularity of surface to a high order of accuracy; and the homogeneous, grainless lacquer that forms this surface, must combine low surface noise with high mechanical strength (quietness with high response).

These specifications are fully met by the full range of Byer Recording Blanks for commercial and general usage; so that, when you use the "BRS" R12 Recorder and Playback Unit with the Byer Recording Blank, you are assured of perfect reproduction — within the limits of the devices transmitting the sound. Your enquiry will be answered quickly and courteously.

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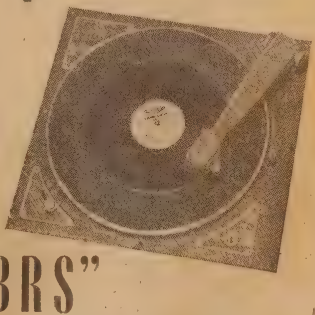
To the enterprising dealer, the R12 Recorder & Playback Unit—proven as fidelity recording equipment—represents a first class opportunity to secure more clients and increase turn-over; make recordings for musicians' and elocutionists' pupils, child prodigies, clients' friends overseas, weddings, choral societies and programmes for radio stations.



"BRS"
R12 RECORDER & PLAYBACK UNIT

BIRNBACH CO. PTY. LTD.
7TH. FLOOR, 55 YORK STREET,
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123 CHARLOTTE ST., BRISBANE,
QUEENSLAND. TEL.: B 2729.

L. S. WISE & CO.
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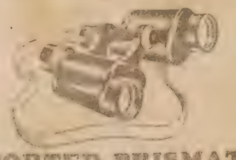
SOUTH AUSTRALIA.



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8 x 30	15 0 0	Wide Angle ..	17 10 0

Wide Angle .. .. 7 x 50 .. .. £25 0 0

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BEST QUALITY SPANNERS

1 steel ¼ x 5/16 Whit. Spanner, 1 steel ⅜ x 5/16 Whit. Spanner, 1 steel ½ x 7/16 Whit. Spanner, 1 steel 11/16 x ⅝ SAE Spanner, 1 steel 15/16 x 1" SAE Spanner, 1 Ring and open end Spanner, 7/16 SAE, 1 Ring and open end Spanner, ½ SAE, 1 Ring and open end Spanner, 9/16 SAE, 1 Ring and open end Spanner, ⅝ SAE, 1 Magneto Spanner, 2BA x 4BA, 1 socket spanner, ⅜ without handle, 1 Ball Pein Hammer, 1½lb, 1 pair Pliers, 1 Metal Toolbox, 5¾ wide x 7 deep x 15" long.

The Lot £3/5/6

Postage: N.S.W., 3/-; Interstate, 5/6.

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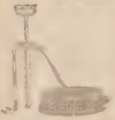

Brand New American Stirrup Pumps, original cost 27/6. These are in perfect condition.

OUT THEY GO.
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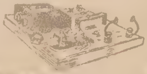

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With Carrying Strap ... ... **5/6 ea.**

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Ex-Army Brand New. 24oz.

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BRAND NEW KHAKI Woollen Serge, S.D. TUNICS. Sizes 4 and 5 only. Unbeatable for hard wear.
ONLY, each **11/6**

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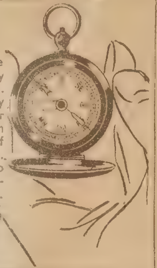

Yes, at last we have procured a quantity of Army compasses. These are a handy pocket size, similar to a pocket watch with a mother of pearl card 1¼in. diam. No need to mention the usefulness of this article.
OUR PRICE
Each **12/6**

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Good English make, brand new. While they last .. .. **6/- ea.**
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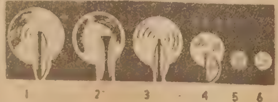

No. 1, Diam. 3⅝ Foc. Len. 10in. No. 2, Diam. 3¾ Hollow Ground. No. 3, Diam. 3¼ Foc. Length 4½in + No. 4, Diam. 2⅜ Foc. Length 6½in. + No. 5, Diam. 1⅛. No. 6, Diam. 1 1-18 Amber Coloured ordinary.

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3oz., slightly used, perfect order .. 9/6 each
10oz., slightly used; perfect order .. 15/- each
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Brand new RAINCOAT, Army anti-gas; 1 brand new sou'wester; 1 pair brand new waterproof Gauntlets.

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ALL SIZES.

Ex-Navy. Brand new, original price, 13/6. These are super quality. Out they go.
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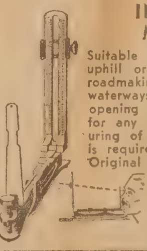

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OUR PRICE, **£5/10/-**

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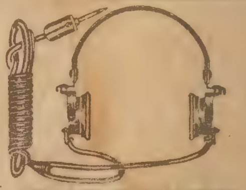

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Brand new, S.T.C. and Stromberg-Carlson. We have just made another purchase of these brand new 'phones, complete with cord and plug, and we are now able to sell them at the ridiculously low figure—130 ohms impedance.
Postage, 1/6 extra. **9/6**
2000 ohms impedance.
Suitable for crystal sets. **£1**
PLEASE NOTE: These phones are brand new, ex-Army, and not military rejects.

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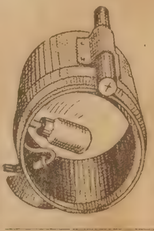

Ideal for fishing, hunting, shooting. Brand new. Original cost £2/15/-. Our price, complete with stand,

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Freight 3/-.
Or complete with P.M.G. Morse Key and light, 23/-.

SORRY, NO C.O.D.

NOTICE OUR NEW ADDRESS PLEASE:

DEITCH BROS.

70 OXFORD STREET, SYDNEY.

10 ohms, 30 ohms, and 50 ohms and 2 each of 100 ohms, 300 ohms and 500 ohms. With these values, it is possible to make up resistances between 10 ohms and 100 ohms in 5 ohm steps and between 100 ohms and 1000 ohms in 50 ohm steps. As a result the ratio dial scale can be marked from .1 up to 10.

With the range switch on the .01 megohm range, the resistances which make up the values between 100 and 1000 ohms can be used to mark the scale from .1 down to .01.

To complete the scale at the other end, whilst on the .01 megohm range, place 100 ohms in the measuring terminals and mark the 100 position. Now switch to the 100-ohm range and use commercial wirewound resistors of good quality to mark the 15, 20, 25, 30, 40 and 50 positions. Resistors which will provide suitable combinations are two 1500 ohms and two 2000 ohms plus the two 500 ohms already mentioned.

CAPACITANCE SCALE

This completes the calibration of the resistance scale. You will note that no attempt has been made to mark positions between 50 and 100. This portion is rather crowded and any readings taken over this portion will be approximate only. Between 1 ohm and 10 megohms the expanded portion of the scale will be used and there is plenty of overlap between ranges.

The calibrations on the resistance can serve also for the markings on the capacitance scale. Due to the difficulty of procuring capacitors of sufficient tolerance for calibration of this scale there is little alternative but to do this. However, the accuracy is quite adequate.

In marking the capacitance scale, start with the centre position 1, followed by the easily observed reciprocals such as 2 for the resistance scale reading of .5, 4 for .25 5 for .2 10 for .1 20 for .05 and 100 for .01. Repeat these markings, but naturally, in the reverse, around the other half of the scale.

INTERMEDIATE MARKS

The intermediate markings will have to be calculated by dividing the desired figure into 1, and then using the resistance scale to pick up the point for the marking on to the capacitance scale.

Finally, intelligent use of the leakage indicator will come with experience. When a capacitor is connected across the leakage terminals, a charging flash will show in the neon tube. The periodicity of further flashes will depend upon the value of the capacitor under test and its leakage resistance, that is, the circuit time constant.

Capacitors with an internal short-circuit will cause the neon to glow continuously; with open-circuited capacitors no initial charging surge will show in the neon.

Every second of the day an average of about 16,000,000 tons of rain and snow fall on the surface of the earth.

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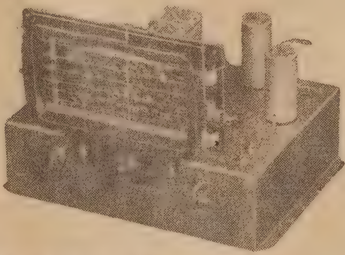

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SPECIAL CHRISTMAS PRICE

ONLY £12/6/6 each

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A TUNER SPECIAL combining

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Getting Started On F.M.

In our review of FM receiver design, the next logical subject for discussion is that of IF amplifier design. We tell you why a certain frequency is chosen, why the transformers are so often loaded with resistors, and the reason for using specialised valve types.

THE majority of present-day superhets use an intermediate frequency of 455 kc, or thereabouts, but this is far too low for any receiver operating on signal frequencies above about 30 mc. whether AM or FM.

Taking the case of a 30 mc signal, the local oscillator would be required to operate at either 29.545 or 30.455 kc, which represents a frequency difference of only about 1.5 per cent. The image frequencies would occur at 29.01 or 30.91 mc, which represents a frequency difference of only about 3 per cent.

OSCILLATOR LOCK

Under these conditions, the local oscillator tends to lock in with the incoming signal, so that no intermediate frequency is produced and the receiver ceases to operate. Even if this effect is prevented, the poor image response causes each station to be heard at two positions on the dial, while signals spaced by twice the intermediate frequency may be heard simultaneously.

What is now accepted as the standard FM band extends from 88 to 108 mc, and this factor, apart from anything else, rules out altogether the possibility of using anything like 455 kc as the intermediate frequency. A much higher figure is indicated.

For an FM system it is necessary to consider also the "width" of the signal in terms of frequency. Unless the tuner—including the IF amplifier—is capable of passing all the components in the modulated carrier, the quality of the signal will suffer appreciably.

In the case of an AM signal, modulation produces sidebands which are displaced from the nominal carrier frequency by the modulating frequency. Thus, a 10 kc modulating tone produces sidebands displaced from the carrier frequency by 10 kc. In actual practice, the majority of AM systems attenuate seriously all sidebands displaced more than about 5 kc—and still manage to produce a signal of acceptable quality.

An FM carrier can also be resolved into a series of sidebands which have to be accepted and passed by the tuning system of the receiver. The pass band involved, however, amounts to much more than the 10-odd kc needed by an AM system.

DEVIATION

As an arbitrary figure, the authorities at present regard a peak carrier deviation of plus and minus 75 kc as being equivalent to 100 per cent modulation. That is to say, with signals of maximum amplitude applied to the carrier, the frequency swings 75 kc higher and 75 kc lower than the unmodulated or nominal station frequency.

On the surface of things, therefore, an FM receiver must be able to deal with a pass band 150 kc wide. Actually, it can be shown that the sidebands extend over an even greater expanse of frequency. By way of example, a carrier deviated by plus and minus 75 kc at 15000 c/s, contains significant sidebands extending for no less than 120 kc to either side of the centre frequency.

After undergoing a change of frequency in a superhet receiver, the same deviation is present, except that the centre reference frequency becomes the nominal intermediate frequency of the receiver.

In determining an actual value for the intermediate frequency of an FM receiver, there is some advantage if the IF is made slightly more than half the total width of the FM band. When this is done, it becomes impossible for image troubles to occur between FM stations in the same part of the spectrum.

Image difficulties can arise, of course, from stations outside the FM band, and this has an influence on the setting of the oscillator frequency—but more of this later.

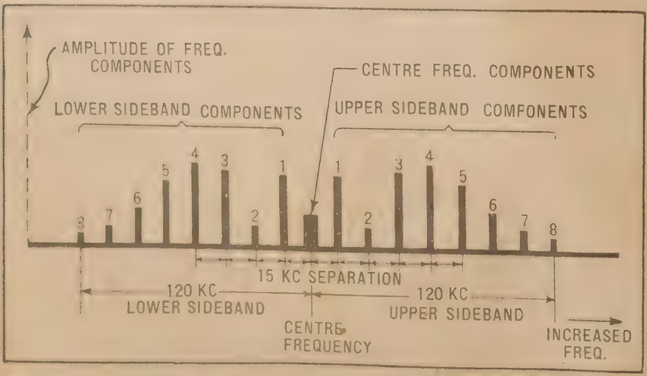
As stated earlier, the FM band extends from 88 to 108 mc, which represents a total bandwidth of 20 mc. To satisfy the foregoing conditions, the intermediate frequency therefore has to be higher than 10 mc, and a figure of 10.7 has become a more or less recognised standard.

HIGH INTERMEDIATES

Apart from overcoming oscillator and image difficulties, a channel operating at this frequency can be made to have an adequate pass band characteristic without undue difficulty.

For radar and television equipment, where the signal and modulating frequencies are still higher, the intermediate frequency gets up to 30 or more megacycles. This does not concern us at the moment, but it does emphasise the digression from normal broadcast AM receiver design.

Even with 10.7 mc IF transformers,



This diagram illustrates the number and the relative amplitude of significant sidebands produced when a carrier is frequency modulated to a swing of 75 Kc. and at an audio frequency of 15 Kc.

the natural selectivity tends to attenuate seriously the sidebands of an FM transmission, and special steps have to be taken to achieve a suitable selectivity curve.

The ideal curve would be one having a flat top, between 150 and 200 kc wide, with infinite attenuation to either side. It is difficult in practice to achieve anything like the ideal, at least in a production line receiver, and some compromise has inevitably to be accepted, exactly as in an AM installation. In practice, the usual selectivity curve has a rounded peak, producing an attenuation of several decibels on the outer sidebands.

The method of achieving something like the desired selectivity curve varies with the ideas of the individual designer, but the methods at his disposal are: (1) resistive loading of the windings, (2) staggered tuning, (3) overcoupling, and (4) special degenerative circuits. The first method is the one most likely to concern us for the time being.

It is not our purpose at the moment to examine in detail the design of IF transformers, since this is normally the task of engineers in component factories. Most constructors will simply receive a set of transformers of the chosen brand and proceed to wire them into the receiver, as indicated.

It is interesting to note, however, by way of example, the approach to the problem adopted by engineers of the AW Valve Company, in designing the Radiotron receiver featured last month.

Having respect to the number of stages which would be required, it was determined that something approaching the required selectivity curve would be attained if the first two transformers were designed to have windings with a "Q" factor of 75.2. Furthermore, that the windings should be critically coupled.

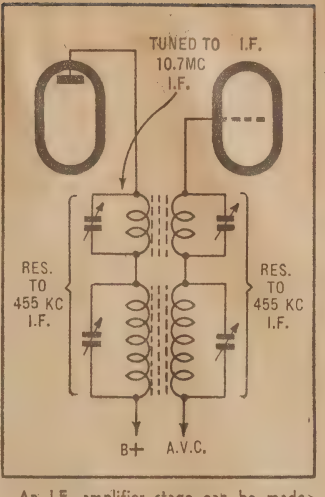
It transpired that a loading resistor of 80,000 ohms was required in parallel with each of the windings to give the required "Q." Coupling was adjusted experimentally to 0.95 of critical on the assumption that a small amount of extra coupling would result from capacitances in the wiring.

SHUNT RESISTOR

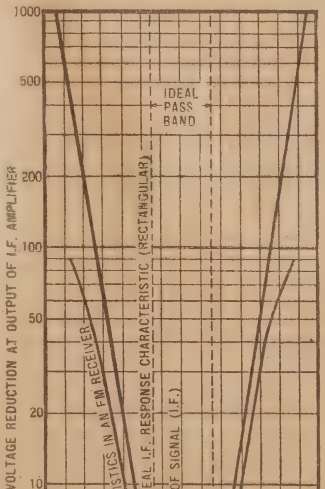
In the complete receiver, the requisite resistor value was connected across the primary, but the secondary was loaded only with a 0.2 megohm resistor. This is effectively in parallel with the grid input impedance of the 6BA6 (0.14 meg at 10.7 mc), the resultant being very close to the required 80,000 ohms.

As a general principle, it is desirable to provide a broadband amplifier with efficient tuned circuits, which are then subsequently "loaded" to reduce their "Q" to the desired figure. The response curve is more likely to exhibit a flat top and steep sides than if the coils are simply wound in a fashion which would give them an inherently low "Q."

From this single example, it is abundantly clear that, for optimum results, the design of the IF transformers has to be correlated with the type of IF amplifier valve, its operating conditions, the number of stages, and so on. A random admixture of components will not render a receiver inoperative, but will compromise the ultimate performance.



An I.F. amplifier stage can be made responsive to both 10.7 Mc. and 455 Kc. by using a double section I.F. transformer, as shown.



A rectangular response curve, regarded as ideal, compared with typical response curves taken on American F.M. receivers.

Very naturally, the choice of a high intermediate frequency and the deliberate limitation of transformer "Q" militates against high gain in the IF stages. Furthermore, as we saw last month, receivers which incorporate a limiter must have sufficient gain prior to the limiter grid to ensure an effective limiting action.

These basic requirements call for something more elaborate than the usual single IF stage, and also for valves which exhibit improved gain and better characteristics generally at 10.7 mc.

In the matter of the valves, this has meant the introduction of types having transconductance figures around 4000-5000, instead of the customary 1600 micromhos. Miniature single-ended construction has been adopted and, in some cases, twin cathode leads.

These features have made it possible to realise satisfactory figures of stage gain, to minimise detuning due to Miller effect, and to minimise risk of instability due to unavoidable coupling across sockets, &c. Many of these points will emerge clearly as the study of FM receiver design progresses.

The two FM tuners described last month incorporated two stages of IF amplification and a ratio detector—an arrangement which involves only three IF transformers in all. The Radiotron circuit used type 6BA6 valves, while our own tuner used ex-Disposals EF50's.

A review of current American designs emphasises the simplicity of this arrangement. Of thirteen types listed, all but four have a more complicated IF channel.

One incorporates two type 6SH7 valves as straight IF amplifiers, with another 6SH7 as limiter. In effect, there are three IF stages and four transformers.

THREE I.F. STAGES

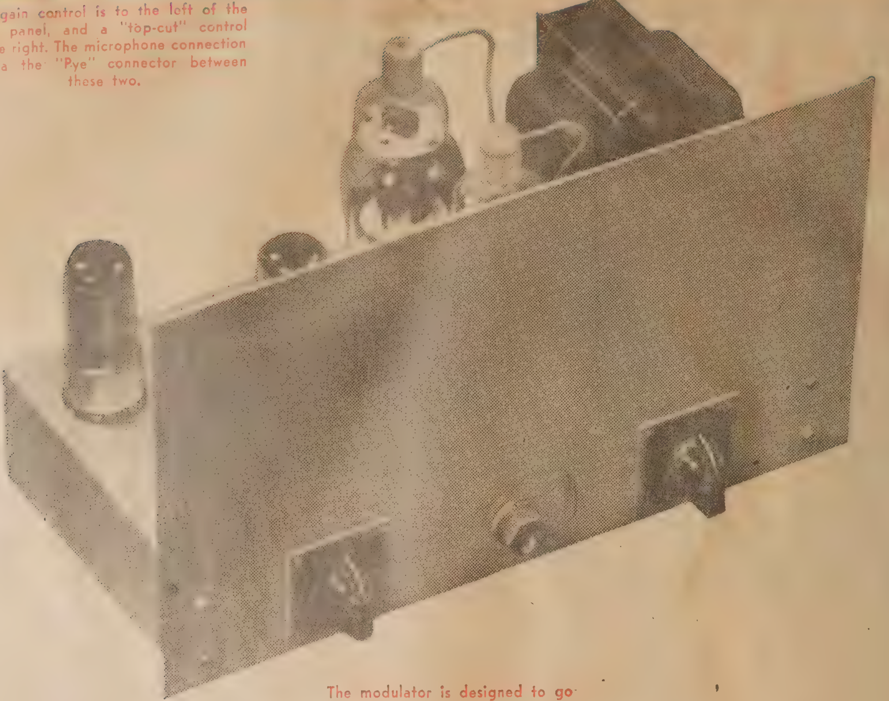
Two other receivers listed use two conventional IF stages, followed by a two-stage limiter. The remaining three receivers have no less than three IF stages, followed by a two-stage limiter. In other words, there are five assorted valves in the IF channel alone.

Valve types mentioned include the 6SH7, 6AK5, 9001, 7AG7, 6SJ7, 6AU6, 6AG5, 12BA6, and 6BA6. A greater variety it is hard to imagine—and this relates only to 13 different FM tuners for which data was available.

As stated last month, stability becomes a problem in a receiver which involves so many amplifier stages on the one frequency. Even though the limiter stages are cut well back in their operating conditions, they still contribute to overall gain and increase the tendency to oscillation. Hence the resort to resistance coupling between successive stages, particularly in the limiter section.

One final point, by way of conclusion. Some American receivers will tune either FM stations or the conventional AM broadcast stations, using the same IF channel.

(Continued on Page 89)



The gain control is to the left of the front panel, and a "top-cut" control at the right. The microphone connection is via the "Pye" connector between these two.

The modulator is designed to go with the receiver, transmitter, and power supply already described.

A SIMPLE MODULATOR

The addition of this modulator will complete your transmitter and provide you with a very efficient little "rig" for either phone or C.W. Two possible circuit arrangements are shown, one conventional and the other giving very high overall gain.

by **W. N. Williams**

THE mechanical work involved in the construction of the modulator is comparatively small, so that it can be dismissed in a few preliminary paragraphs.

The chassis measures 11in. x 6in. x 2in., and thus matches the accompanying transmitter and power supply units. Similarly, the front panel is 12in. x 6¾in., so that the three units should mount very neatly in a small table or shelf-mounting rack.

The panels on the original transmitter were of aluminium, matte finished by rubbing under a tap with emery cloth. You may prefer a grey lacquer finish, with lettering to indicate the purpose of the various knobs and switches. A couple of indicator bezels could also be added to show when the equipment is on. However, these are merely finishing touches which you can add or omit as you please.

Viewing the chassis from the front, the modulation transformer is at the rear, on the right-hand side, with the 807 output valves alongside it. Near the centre of the chassis is the phase splitter valve, with the voltage amplifier in the near left-hand corner. A spare valve hole in front of this again can be used for an additional stage, although this should not be necessary in the normal course of events.

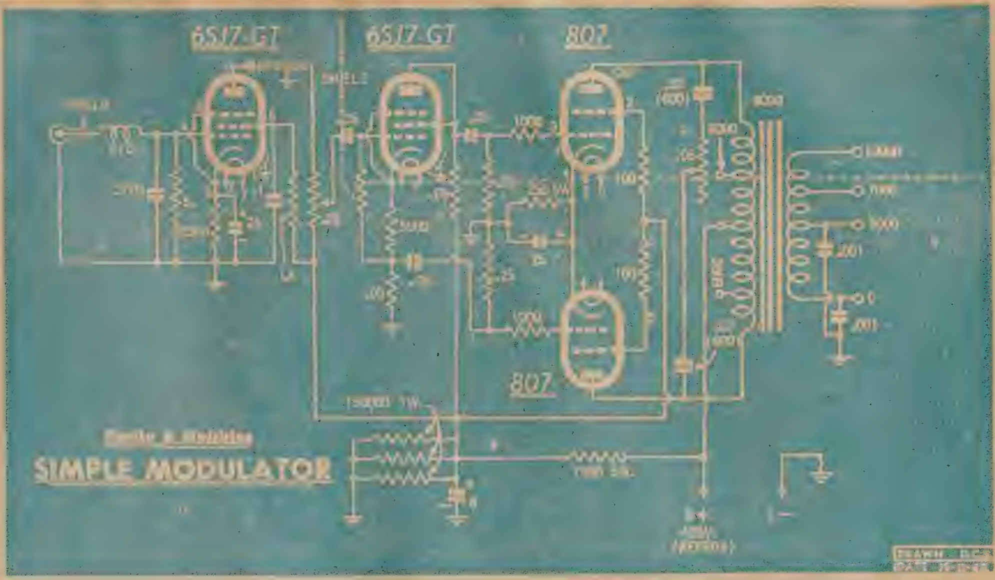
On the front panel, the volume control is on the left, the microphone input socket in the centre, and the tone control on the right. These will be referred to again elsewhere in the article.

Reviewing the circuit arrangement, the input power to the final plate and screen is likely to be about 40 watts. Following the well-known relationship, this calls for an audio power output from the modulator of about 20 watts.

In practice, a figure slightly less than this will do, since the power on voice peaks is generally higher than the nominal power, as measured with a steady tone sine-wave output.

We have assumed the use of plate modulation, simply because we feel it to be the best proposition for an amateur station. Taking this transmitter as an example, we can expect a carrier power of just over 22 watts, with a plate input of 400 volts at 80 milliamps. With grid modula-

CIRCUIT DIAGRAM OF THE SIMPLE MODULATOR



The circuit is quite straightforward, and gives about 20 watts output—ideal for any low-powered transmitter.

tion, the rated carrier power is only 9 watts.

Even allowing that one can take certain liberties with the operating conditions, the carrier power with any form of efficiency modulation is not likely to exceed about 12 watts. The whole point about grid, screen or cathode modulation is that the operating efficiency must be limited initially, if reasonable linearity is to be achieved.

Fortunately, it is not difficult to obtain the 20-odd watts required for plate modulation. It comes very conveniently from a pair of 807 valves operating under resistance-coupled class AB1 conditions. In this respect, the new modulator is similar to the 20-watt amplifier described some time back.

The output valves are provided with suppressor resistors for both grids and screens. These are inexpensive and represent an effective precaution against parasitic oscillation. The screens are fed through a resistive divider network, which not only contributes to voltage regulation, but provides an additional stage of low frequency filtering. You will find that the modulator is completely free from hum.

TONE CONTROL

Negative feedback is not necessary, since a modulator operates into the substantially constant load provided by the modulated amplifier. There are no radical variations in the value and nature of the load, as when an amplifier is feeding into a loudspeaker.

You will note, however, that a simple tone control is connected between the plates of the output valves. It balances the layout of the panel, but also serves a useful purpose. Most of the microphones which nowadays grace the amateur "shack" have a peaky top response, which is all to the good for DX working. For local contacts, however, the same biting, metallic quality is neither necessary nor desirable, and proper adjustment of the tone control can correct this.

The modulation transformer is an important component and warrants full consideration. The 807 valves require a plate-to-plate load of from 7000 to 8000 ohms. On the secondary side, it can be assumed that the final amplifier will draw a total plate and screen current of about 85 milliamps from its supply of just over 400 volts—giving a load resistance figure of 5000 ohms.

The transformer must therefore have an impedance ratio of 8000 CT to 5000 or a turns ratio of 1.25 to one. Very obviously, the ratio offered by a conventional power transformer would be hopelessly wrong, unless it happened to have a secondary rated at 150 volts per side. Even then its performance would depend on its ability to handle the audio power and to cope with the d-c flow through the windings.

The preferred method is, of course, to purchase straight out a suitable modulation transformer and

PARTS LIST

1 Chassis 11" x 6" x 2".
1 Panel 12" x 6¾".
1 25 Watt Modulation Transformer (8000 C.T. to 5000 ohm).
1 Small Multi-Section R.F. Choke.
1 Microphone Plug and Socket.
3 5-pin Sockets.
2 Octal Sockets.
1 5-Pin Plug.
2 807 Plate Cap Connectors.

CONDENSERS.

2 25mfd 40V Electrolytic.
1 8mfd 525V Electrolytic.
1 0.1mfd Tubular.
3 0.05mfd tubular.
2 0.02mfd 600V Tubular.
2 .001mfd Mica.
1 .0001mfd mica.

RESISTORS.

1 5 Megohm.
1 1.5 Megohm.
1 1 Megohm.
2 .25 Megohm.
1 .25 Meghom Potentiometer.
3 .15 Megohm.
2 50,000 ohm.
1 50,000 ohm Potentiometer.
1 25,000 ohm.
1 7,500 ohm 5 Watt W.W.
1 5000 ohm
1 2000 ohm
2 1000 ohm
1 250 ohm 5 Watt W.W.
2 100 ohm Resistors.

VALVES.

2 6SJ7-GT, 2 807.

SUNDRIES.

Shielded wire, hook-up wire, short length plastic flex, 7 - 1" spacers, bakelite resistor strip, nuts and bolts, solder lugs, 2 - indicator plates, &c.

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[illegible] volt Dunamotor. Gives 300 volts [illegible] 40 M/A. Will also work as 12 or 24 volt motor. Price, 35/-.
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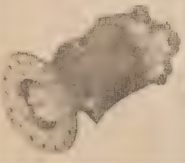

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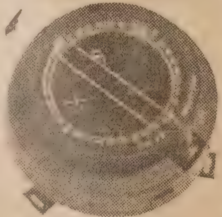

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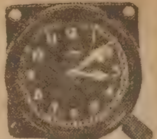

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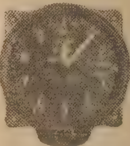

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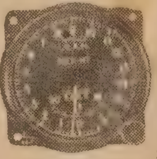

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Grid excitation for the 807's comes from a triode phase splitter, operating in conventional fashion. We have suggested a 6SJ7-GT, simply because it is a more handy valve to have around than say a simple 6J5-G. The first voltage amplifier valve is also 6SJ7-GT, operating as a pentode voltage amplifier. Here a point of complication arises.

Many amateurs, these days, use crystal michophones, the imported crystal inserts being particularly popular. These must operate into a load of about five megohms, so that it is not feasible to have a volume control across the input jack. The highest value of control commonly available is 1.0 megohm.

VOLUME CONTROL

Since a volume control is essential, the only place for it is between the first and second valves. A further complication follows, in that the second valve is a phase splitter, with both ends of the grid circuit above earth. To avoid the necessity for extra wiring and components, therefore, we simply make the volume control serve also as the plate load resistor, taking the coupling condenser away from the tapping.

The volume control is well able to handle the plate current of the 6SJ7-GT, while the very low gain after this point ensures that there will be no trouble with noise as the control is operated.

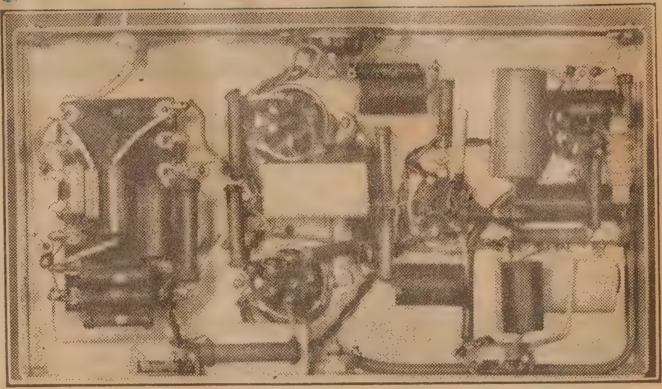
This system can be used only where the signal input is of a comparatively low order, as from a microphone. The output from a typical pickup, fed straight to the grid, would overload the first valve, irrespective of the volume control setting.

For the input circuit, we suggest that you use a shielded microphone plug and socket. The one shown in the original modulator is an ordinary "Pye" coaxial connector, as fitted to most British service equipment. We have used phone plugs and jacks in the past, but they tend to be noisy and to give trouble with RF feedback, due to incomplete shielding.

R.F. FILTERING

The RF choke and the bypass at the input grid circuit is a further precaution against RF feedback. Use a small multi-section choke for preference and tuck it down into the fold of the chassis to afford some degree of shielding. However, the gain of the amplifier in this form is not very high, and trouble with feedback is not likely to occur.

CHASSIS COMPONENT LAYOUT



This underchassis view gives an idea of component layout.

The gain of the modulator is actually just high enough to yield full output when using a crystal microphone under close talking conditions. In practice most amateurs use their microphones this way to avoid trouble with room echoes and competition from the local poultry. The gain will be adequate also for high output carbon microphones.

Other types of microphone may require substantially higher overall gain, and this brings to light an interesting circuit arrangement which we have not previously featured in Radio and Hobbies. It provides an enormous increase in overall gain without the addition of an extra valve.

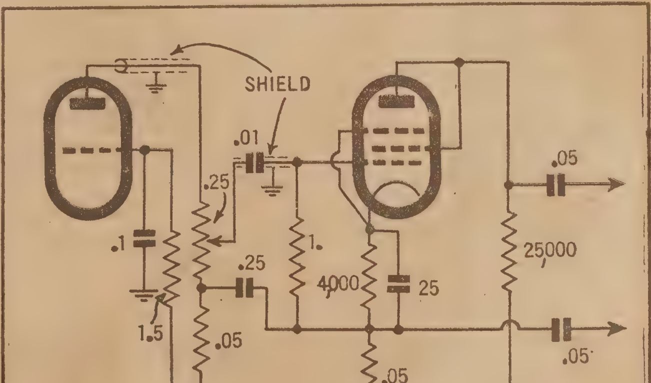
The amended circuit arrangement is shown, and it is a very simple matter to incorporate it in the modulator. The changes affect fundamentally the operation of the pentode voltage amplifier.

It will be noted that an extra 50,000 ohm resistor is connected in series with the plate load resistor of the first valve, the junction being coupled across to the cathode circuit of the phase splitter. The cathode load now becomes effectively 25,000 ohms, made up of the normal 50,000 ohm cathode resistor and the extra 50,000 ohm plate resistor, which is effectively in parallel with it as far as audio frequencies are concerned.

Since the cathode load of the phase splitter is now 25,000 ohms it is necessary to reduce the plate load resistor to this same value to preserve a balance of grid drive to the 807's.

The effect of the alteration is that the signal voltage developed in the cathode circuit of the phase splitter is fed back into the plate load of the pentode. This feedback modifies drastically the load conditions in the

(Continued on Page 91)

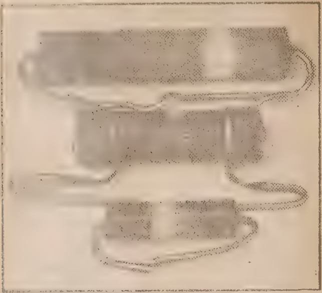


Higher gain is obtained by using this circuit.

FOR THE JUNIOR EXPERIMENTER

It's truly amazing just how much there is to even the simplest components in a radio set. This month we will tell you more about resistors—what they look like and how they are made. Lastly there is the important subject of wattage rating and heat dissipation.

AS the name suggests, a resistor is connected into a circuit for the specific purpose of introducing a known amount of resistance. Why one should want to do this will be explained later in the article.



Typical carbon resistors.

Resistors can be divided into two broad classes, namely wire-wound and carbon, and, once again, the terms are more or less self-explanation.

Wire-wound resistors consist simply of a number of turns of special wire wound on a small former and provided with tinned leads for connection into circuit.

The wire used for these resistors is special alloy or metal, chosen because it exhibits a definite resistance to the passage of electric current. Three common types of resistance wire are known as "Advance," "Nichrome" and "Eureka," and the resistance of these various wires is quoted in some wire tables.

WIRE RESISTANCE

By way of example, a 1000-foot length of 36 B. and S. Nichrome exhibits a d-c resistance of 27,000 ohms, as compared with 414.8 ohms for the same length of copper wire. Advance wire of the same gauge shows 11,760 ohms per thousand feet, while Eureka wire has much the same d-c resistance.

It is noteworthy that some types of resistance wire do not amalgamate well with solder, so that the junction between the wire and the pigtail lead is made a mechanical one by the process of clamping and twisting the resistance wire around a lug, or, in some cases, by welding.

The manufacture is completed by coating the whole resistor, apart from the pigtail ends, with a suitable enamel and marking with type number and resistance rating.

Some wire-wound resistors are coated with ordinary lacquer, and must not be operated under conditions which will make them become more than merely warm to the touch. If they are run hot, in the usual sense of the term, the assembly will char and disintegrate, allowing the turns to move from position and upset the value of the resistor.

These remarks apply more especially to resistors wound on a cardboard, rather than a glass former, where the cardboard itself is likely to distort and crack under the influence of heat.

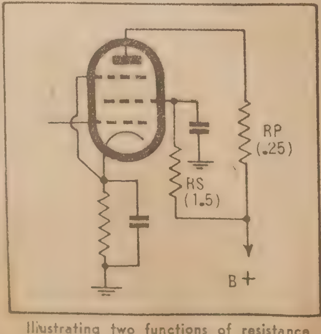
On the other hand, some wire resistors are wound on a porcelain or ceramic former, and given a heavy coating of special enamel, which is baked and hardened in an oven. Such resistors will operate more or less indefinitely at a temperature too hot to touch.

VALUES

Wire-wound resistors are fairly common in values up to about 5000 ohms, beyond which carbon resistors are more usual. However, it is possible to purchase wire-wound resistors in values up to 50,000 or even 100,000 ohms, where they need to pass a considerable amount of current.

Ordinary wire resistors are wound in the form of a simple coil, so that, in addition to providing the required amount of resistance, they exhibit a certain amount of inductance, since they are in effect a solenoid coil. This inductive property may be of no importance or it may be a good or bad feature, depending on the specific circuit application. Broadly speaking, where a circuit calls for a non-inductive resistor, this special requirement will be indicated in some way.

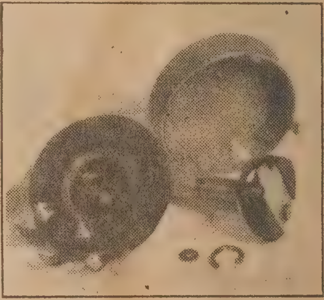
The non-inductive quality can be specified by using a carbon resistor or special form of wire-wound resistor, in which the winding is doubled back on itself, so that half the turns are wound in one direction and the other half in the opposite direction, giving a cancellation in the magnetic field.



Illustrating two functions of resistance in a circuit.

Carbon resistors have a resistance element made by compounding finely divided carbon with a binding substance, which will give the desired resistance in an element of given dimensions. If the carbon is comparatively pure, the resistance would be low, while decreasing the proportion of carbon increases the electrical resistance.

In some resistors the element itself is simply fitted with pigtails, immersed in a lacquer and suitably color coated. In others the resistance element is moulded into a bakelite shell, leaving only the pigtails to protrude.



Showing the works of a carbon potentiometer.

Now a word about tolerance values. If a particular resistor is marked 0.1 meg., it does not mean that its resistance value is exactly 100,000 ohms—no more and no less. Actually, considerable variation does occur in the normal process of manufacture and, unless otherwise stated, the tolerance one can expect is plus or minus 10 per cent. That is to say, given resistor can be up to 10 per cent. high or low in value. Thus, our nominal 0.1 resistor may actually measure anything from 90,000 to 110,000 ohms.

In general, circuit requirements are such that a tolerance of 10 per cent plus and minus is quite permissable and, in fact, it is usually present in the characteristics of other components as well, including the valves.

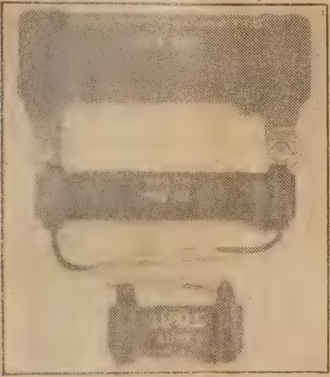
Where the circuit application calls for an accurate resistance value, it is normal to specify a tolerance of 5 per cent or less, the resistor having to be procured in most cases on special order. However, as we stated before, the usual circuit does not call for this degree of exactitude, and no benefit would be realised if resistors of ordinary tolerance were replaced throughout by precision units.

In last month's article we mentioned tapped variable resistors and these divide themselves into certain definite classes.

A tapped resistor is a unit—generally wire wound—in which a connection is provided to each end of the resistance element as well as to a point half way along it.

A semi-variable resistor — again usually wire-wound—has a connection to each end of the element and a sliding clip which can be moved along and tightened so that it makes contact at any desired point on the resistor. The best example of this type is the conventional voltage divider which may have two or three movable clips along its length.

Fully variable resistors usually have their resistance element arranged to form the arc of a circle with a connection at each end and a sliding contact which is moved along the element when the control shaft is rotated. Such resistors may employ a resistance wire element or one having carbon impregnation.



The largest resistor is 2in. long and is rated to dissipate 20 watts. The smaller resistors are rated respectively at 5 watts and 3 watts.

If the control has three connections —two ends and the tapping—it is conventionally referred to as a "potentiometer." Where it is provided with only one end connection and the tapping, it is often referred to as a "rheostat."

Just in passing it is worthwhile to note that carbon potentiometers are conventionally made so that the spindle is electrically insulated from the resistance element and the tapping. On the other hand, wire-wound potentiometers, commonly have the spindle at the same potential as the tapping, which means that it needs to be insulated from the chassis with suitable washers, unless the circuit specifically shows that the tapping is "earthed."

One of the limiting factors in the application of a resistor is the heating effect of the current passing through the resistance element. This is expressed in watts and determined by the formula.

W equals E squared/R; or W equals I squared R, where W is in watts,

(Continued on Page 77)

FOR "Solo Listening"

"ACOS"

HUSHAPHONE

Enjoy the best in radio entertainment without disturbing others! Instal the unique Acos Hushaphone on your radio set, tuck it under your pillow, and then relax. When there's sickness in the house . . . whilst others are trying to sleep . . . when a second radio in your home is broadcasting a programme you don't want . . . these are just some of the times you need a Hushaphone for solo listening.

Attractively styled in gleaming plastic case and smart chrome finish. Your local Radio Retailer can quickly and easily connect it to any type of radio receiver.

Tone quality of the Hushaphone compares favourably with cone-type speakers. Light weight Bimorph crystal drive ensures uniform response, and high sensitivity.

Price - - - £3/16/4.

Obtainable at all good radio and electrical stores.

Sole Australian Distributors:— AMPLION (Australasia) Pty. Limited.

36-40 Parramatta Rd., Camperdown, Sydney, N.S.W.

50/2FC.5.

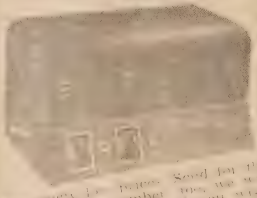
EVERYTHING FOR THE RADIO ENTHUSIAST

Yes, Mr. Radio Enthusiast, *everything!* Is it radio kit-sets you want? *We have the biggest range of kit-sets in Australia!* Amplifiers? *One of the 8 listed below is sure to suit you!* Test Equipment? *We have a "University" instrument for every purpose!* If it's valves, resistors, RCS and Kingsley lines, Ferguson transformers, batteries, or any replacement parts, remember, Electronic Parts for *all* your radio requirements.

WE ARE DISTRIBUTORS OF EVERYTHING IN RADIO

8 DIFFERENT AMPLIFIERS

Complete or Kits



Yes, Electronic Parts have an amplifier for every sound enthusiast — the 4.5 watt Vox Minor, 10 watt General Purpose, 12 watt Vox Major, 15 watt Ultra High Fidelity, 20 watt All Purpose, 45 watt Super Power P.A., 4 watt Vibravox, and 13.5 watt Vibrator Amplifier—all at amazingly low prices. Send for the Amplifier Price Leaflet today, and remember too, we will build it up for you at a small extra charge if you wish.

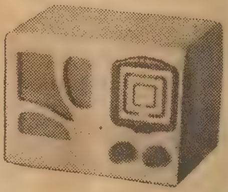
MK1 MULTIMETER KIT

Handy, compact, and attractively priced, this Multimeter Kit is the perfect instrument for service calls and bench work. Compares more than favourably with commercial multimeters. Full constructional details are included with every kit, and assembly is easy as no calibration is required. Price £8/16/0 plus postage. Post coupon for Instrument Leaflets.

AST SUPERTRACER

University Model A.S.T. is the most up-to-date and efficient instrument available for the serviceman who must have the best. Comprising a multi-range V.T.V.M. and four band tracer with both audible and visual signal indications, A.S.T. is the last word in test equipment. It's a radio set and a signal tracer in one. Read all about it on the Instrument Leaflet.

50 DIFFERENT KIT-SETS

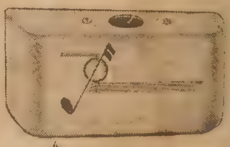


All the popular kits are featured in the E.P. Kit-Set Leaflet. Send for it today and pick out the kit you want for Christmas. Portable? Radiogram? Beginners' Set? Mantel Model? We've got them all—and at bedrock prices. Post the coupon **Now.**

OK1 OSCILLATOR KIT

Companion model to MK1 and same neat size —6in. x 8in. x 2½in., this kit covers all fundamental frequencies in the average receiver. Together with MK1 will locate all common faults in radios. OK1 is easy to operate as dial is specially calibrated and kit uses standard batteries. **Price £8/16/0** plus postage. Full details on the Instrument Leaflet.

"UNIVERSITY" DOOR CHIMES



Want to bring a new note into office or home? Then discard those clangorous bells and install a new "University" Door Chime. Mellow and soothing, yet penetrating, and finished in soft pastel shades, this chime is a happy welcome to your visitors and a sure sign of your own good taste.

Operation is from either A.C. or batteries. Make Mum a gift of one for Xmas. Only 29/6, plus 1/6 postage.

FILL IN THIS COUPON NOW!

ELECTRONIC PARTS PTY. LTD
206 Broadway, Sydney, N.S.W.

Please send me, without obligation, details of the items marked below:

Radio Kit-Sets	**"University" Test equipment**
Amplifiers	**Door Chimes**

NAME ....

ADDRESS ....

Merry Christmas!

ELECTRONIC PARTS PTY. LTD.

E. S. and A. Bank Building
BROADWAY, N.S.W.
Phone: MA 1661.

TRADE REVIEWS AND RELEASES

MULLARD RELEASE NEW LINE OF RECEIVERS

Mullard-Australia Pty., Ltd. have recently released a new line of receivers, which include an attractive portable and a table radiogram. Details of four new receivers are given below.

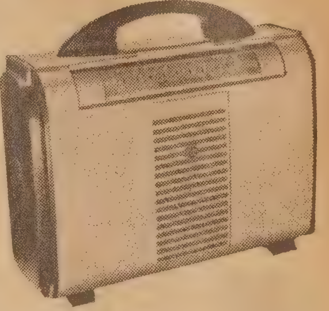
THE table radiogram, model MAS1104, incorporates a 5-valve a-c operated receiver. It provides normal broadcast coverage and incorporates a 6-inch loudspeaker.

Valve complement is ECH35, 6SK7-GT, 6SQ7-GT, 6V6-GT and 6X5-GT. The cabinet is of veneered plywood and measures 18 x 12½ x 20 inches. Controls are at the side, and a lift-up lid reveals a spring-mounted Garrard record player for either 10 or 12-inch records.

A special feature is a removable base plate, which gives access to the bottom of the chassis without removal from the cabinet. Retail price is 48 guineas.

The portable, illustrated on the right, is a 5-valve receiver, arranged to operate from either internal or external batteries. With broadcast band coverage, it uses two 1T4 valves, a 1R5, 1S5, and a 1Q5-GT in the output stage. Speaker is a 6-inch type.

The set is housed in an aluminium cabinet 13 x 9½ x 5½ inches, and includes an in-built loop and connections for external aerial and earth. A special dial shutter protects the scale during transit and acts also as an "off-on" switch.



Weight of the receiver is 15lb and the retail price is £29/19/6.

Other receivers, not illustrated, are models MAS1107 and MAS 1103. The first of these is a 5-valve broadcast table model receiver, housed in a moulded bakelite cabinet fitted with an 8-inch loudspeaker. It measures 16 x 11 x 8 inches and has volume, tone and tuning controls. It has a built-in plate aerial, with provision for an external aerial, if required. The base plate is removable for ease of servicing.

Model MAS1103 is generally similar, except that it has provision for dual-wave reception. Price of the dual-wave set is £29/15/- and for the broadcast only model, it is £25/10/-.

The new sets are on display by Mullard dealers.

MIDGET CONTROLS

THE Morgan Crucible Co. advise that they hold stocks of midget Morganite volume controls. Maximum overall diameter is ¾-inch and they protrude approximately 5-8-inch behind the mounting panel.

Only 0.5 megohm controls are available at the moment, although other types are planned for local production. Retail price is 4/6.

Enquiries should be addressed direct to the Morgan Crucible Co., A'sia Pty., Ltd., Bourke Road, Alexandria.

TERMINALS IN TECHNICOLOR

WE have received advice that Jabel Products are now manufacturing their spring terminals in a range of colors, to meet special requirements.

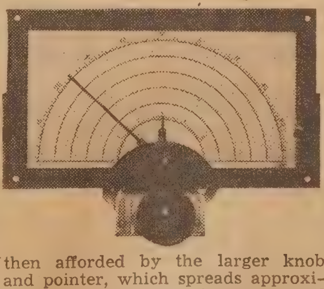
Apart from the usual red and black, the terminals are now available in yellow, green, and two distinctive shades of blue.

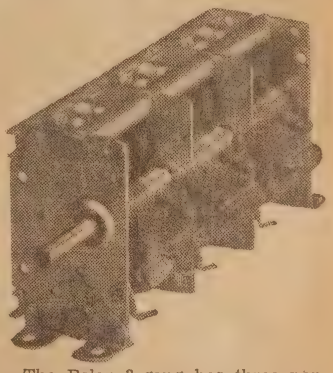
Supplies are available through trade houses. Trade inquiries to Watkin Wynne, 173 Pacific Highway, North Sydney.

COMPONENTS FOR S/W SETS

AMONG lines recently imported from Great Britain is a dial by Jackson Bros. and a special Polar 3-gang.

By means of a special drive mechanism, the gang can be set initially to any point in its travel by means of the smaller knob and scale. Mechanical bandspread is then afforded by the larger knob and pointer, which spreads approximately 30 degrees of gang travel over 180 degrees of the scale. Space is available for hand calibration. Retail price is approximately £2.





The Polar 3-gang has three normal sections for ordinary tuning, plus an additional set of plates for bandspread or F.M. reception. Approximate price of the 2-gang version is 29/- and 43/- for the 3-gang.

Trade inquiries to British Merchandising Pty. Ltd., 183 Pitt Street, Sydney.

FREE WITH EVERY "Q PLUS" CAR RADIO COIL KIT

1 Car Radio Circuit — 1 Constructional Hints Sheet

Build it NOW for Xmas and Holiday Time

Now at long last you can build yourself a car-radio with the performance of the commercial units—for "Q Plus" engineers have made available these special coils which match the whip-type antenna with coaxial lead-ins—midget in size—Giant in performance.

THE KIT COMPRISES

- 1 only "Q plus" Q+O5S oscillator coil.
- 1 only "Q plus" Q+AC2S Aerial coil.
- 1 only "Q plus" Q+RC2S R.F. coil.
- 1 only ignition hash coil.
- 1 pair "Q plus" midget I.F. Transformers.

Complete with recommended circuit and a host of construction tips

Retail Price 57/6

SPECIFICATIONS

Size:—

Aerial, RF & Oscillator Coil—¾" x ¾" x 1½".

I.F. Transformers, ¾" x ¾" x 2".

Phantom Drawing showing 2/3 size "Q Plus" midget coil construction.

CONSTRUCTION

All coils are Litz wound, permeability tuned with iron pot surrounds — Can specially lined with iron dust to increase efficiency.

Single hole mounting with special flush solder lugs, for small chassis.

R. W. STEANE & CO. LTD., Auburn, Vic.

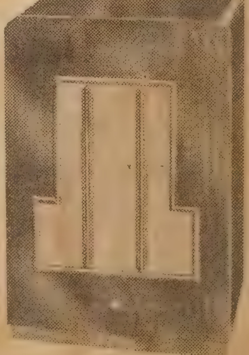
Stocked by all Modern Radio Houses throughout Australia.

RECORD ENTHUSIASTS

R. W. STEANE & Co. Pty. Ltd.
143 HIGH ST., KEW, VIC.

ANNOUNCE:—

VENTED BAFFLES



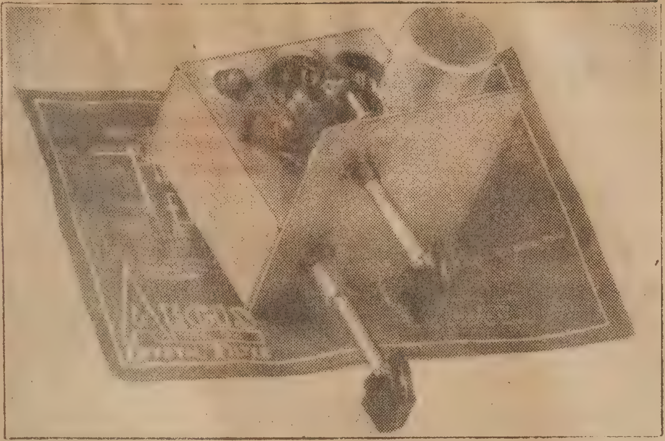
Illustrated is the special model assigned for the famous GOODMAN'S AXIOM 12 Speaker. Designed for better listening the unit is solidly constructed of 7-8" core wood, handsomely figured in Queensland Maple, and highly polished, to take its place with pride in any surroundings. Totally enclosed, the unit has an attractive silk front and the inside is generously lined with heavy felt.

SPECIAL INTRODUCTORY PRICE:—Polished £15/15/- or with GOODMAN'S "AXIOM 12" Speaker, £29/10/-. (Output transformer extra). Also available unpolished.

Consult us for special vented baffle designs or your other problems.

Mail Orders especially catered for.

AEGIS CRYSTAL FILTER UNIT



FROM the Aegis Mfg. Co. comes the crystal filter unit depicted above. Completely assembled and wired, it is ready to include directly in a communications type receiver. The crystal must be purchased separately.

The unit forms an approximate 3½-inch cube, and has two controls. The top shaft gives five degrees of selectivity, the extreme left position removing the crystal completely from circuit. The bottom control is for crystal phasing and is conventional in its operation.

Designated as type CF-1, the unit comes packed in an attractive carton and is accompanied by a circuit blueprint and a sheet containing general information on the application and adjustment of the filter.

Enquiries may be addressed to Aegis distributors or to the Aegis Mfg. Co. Pty. Ltd., 208 Little Lonsdale St., Melbourne, C1.

News from "Denradio"

A RECENT circular from Denradio Industries, of Maryborough, Qld., refers to an item which will be of particular interest to campers and country readers. It is the Sanutrene Electrosan.

As the name suggests, it is an electronic attachment intended for use in chemical closets, and obviating the need for chemicals. Portion of the equipment attaches to the wall and it operates from a storage battery or any other convenient source of power.

The device is especially recommended for use in caravans or in situations where freedom from odor is essential.

"RED LINE" From U.R.D.

Messrs. United Radio Distributors Pty. Ltd., of Phillip Street, Sydney, have been appointed a distributor for "Red Line" equipment in New South Wales. U.R.D. propose to carry a wide range of "Red Line" products, notably filter chokes, audio and power transformers.

"Radameta" Prices

FROM the manufacturers of "Radameta" test equipment comes a price list for a range of modulated service oscillators. These cover the range from 110 kc to 42 mc. and are housed in a crackle finished case, with directly calibrated scales.

Model (RO68) ac-operated, 195 volts to 275 volts, 40 to 60 cycle, modulated by mains frequency, £10/16/-.

Model (RO78), same as above, fitted with built-in 6-volt vibrator unit, £13/15/-.

Model (RO88), ac-operated, 195 to 275 volts, 40 to 60 cycle, 400 cycle modulation, £13/5/-.

Model (RO98), same as above, fitted with built-in 6-volt vibrator unit, £16/5/-.

Model (RO108), battery model, 400 cycle modulation, complete with batteries, £13/5/-.

All prices subject to 10 per cent sales tax). From Radameta Test Equipment, Fowler Rd., Guildford, NSW.

Do you own a portable radio?

You'll get maximum power when you use . . .

EVEREADY
MINI-MAX
BATTERY FOR PORTABLE RADIOS

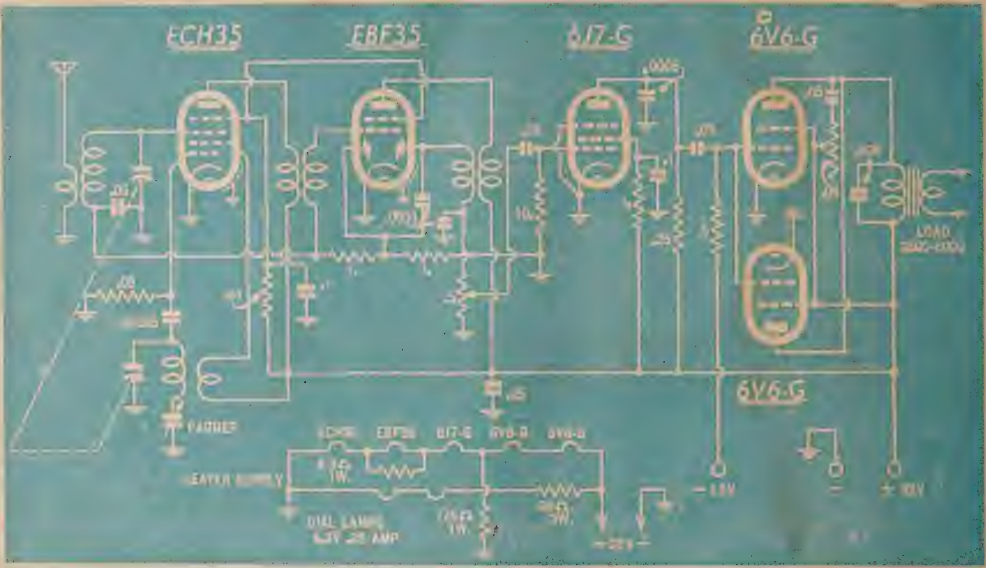
EVEREADY
TRADE MARK
MINI-MAX
TRADE MARK
BATTERIES

The world's best selling PORTABLE BATTERIES —
LAST LONGER, TOO!

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A RECEIVER FOR A 32-VOLT LIGHTING PLANT



This month's feature will be of special interest to country readers, since it concerns a receiver which operates directly from a 32-volt home lighting plant. The contribution comes from Mr. Thompson, of "Gleamlands," Mt. Tully, Stanthorpe, South Queensland.

IN constructing a set of this type one can either provide some form of vibrator high tension supply or omit the vibrator altogether and make do with the available 32 volts for the plate supply. The problem then is to obtain adequate gain from the valves and enough power output to operate a loudspeaker.

A few special valves are available overseas for low voltage operation, but they are not manufactured or sold locally. Mr. Tully has met this problem by connecting in parallel a pair of 6V6-GT valves and operating them with a small amount of battery bias to avoid the loss of voltage which would be incurred by a cathode resistor.

Concerning actual gain, Mr. Tully says that he has had good results from the circuit as it stands, even though it is, to all intents and purposes, a conventional superhet tuner with no RF stage and only one stage of IF amplification. In less favorable areas an RF stage would be an asset, however.

As it is, he receives about 17 stations during daylight hours and as many as can be fitted into the dial space at night. For aerials he has used anything from the frame of a bed to an iron roof.

For the sake of economy the heaters of the valves are operated in series, with shunt resistors to make up for certain inequalities in current rating.

The heaters of the 6V6-GT valves pass 0.45 amp so that this total current must flow through the network. A 125-ohm 5-watt resistor in parallel with the other three heaters carries the excess 0.15 amp.

The 6J7-G and the ECH35 each carry 0.3 amp, but the current rating of the EBF35 is 0.2 amp, so that a parallel resistor of 63 ohms 1 watt is required. If difficulty is experienced in obtaining a resistor of approximately this value it can be made up by connecting in parallel two 3-watt resistors rated respectively at 100 and 170 ohms.

By the same token, the 125-ohm 5-watt resistor can be made up by connecting in parallel two resistors each rated at 250 ohms three watts.

HEATER VOLTAGE

The total voltage of the heaters adds up to 31.5, which is near enough to the line operating voltage for all practical purposes. No additional series dropping resistor would be necessary unless the operating voltage with the lighting plant in operation exceeded 35 volts. Mr. Thompson's original circuit actually included a 5-ohm resistor in series with the heater network to provide a small additional voltage drop.

The dial lamps are connected in series and fed through a separate 80-ohm 3-watt resistor. Two 150-ohm resistors connected in parallel will be close enough to the required value.

A check on the operating conditions of a 6V6-G under low voltage conditions indicates that between 50 and 100 milliwatts will be available from the parallel connected valves,

(Continued on Page 83)

"*The* YORK"

4 VALVE BROADCAST MANTEL

KIT SET

"The York" features:

Attractive Bakelite Cabinet (as illustrated); size $10\frac{3}{4}$" x $6\frac{3}{4}$" x $6\frac{1}{2}$". Also available in cream.

Rola 5 inch speaker.
R.C.S. Intermediates.

Valves, 6J8G, 6G8G, 6V6GT, 6X5GT.

Full Vision Dial.

A proved circuit with full instructions, easy to follow.

Complete to the last nut and bolt, including valves.

Price
£15/19/-
retail

Attractive Discounts to the Trade.

Build your own Radio Set and save pounds.

BLOCH & GERBER LTD.

WITH WHICH IS ASSOCIATED

THE WELDON ELECTRIC SUPPLY CO.
46-48 YORK STREET, SYDNEY
TELEGRAMS "LESAB" SYDNEY
MA6291 (10 LINES)

Also supplied as a Foundation Kit Set—a boon to the small manufacturer. Prices on Application.

DISPOSAL BARGAINS

BENDIX SCR. 522 TRANSCEIVERS

18 VALVES

100 to 156 Megs. Good Order. Complete with Valves.

£12/10/-

1143 TRANSCEIVERS

20 Valves
100 to 125 Megs.

***New* £12/10/-**

Including Valves
4 EF50, 4 EF39, 2 EF36, 4 EL2, etc.

Genemotors 24v. For above £3/-/-

TEST EQUIPMENT

PALEC V.C.T.

Complete Valve and Circuit Tester.
A.C. Operated
TESTED AND GUARANTEED PERFECT

£12/10/0

V.C.T.V.

For A.C. or 6 Volt Vibrator Power

£14/10/0

VIBRATOR RADIOS

NEW 5 VALVE
In Beautiful Moulded Cabinet

£18/19/6

Ideal For Home, Boat or Caravan.

VALVES

All New & Guaranteed

1A4
6B6
6J7
6U7
6Q7
6V6
6SA7
12A6
12SK7
12SR7
12SQ7
12SG7

12/6 Each

ALL TESTED 100%

6SH7
CV6
1K5
1K7
6H6

7/6 Each

EXCELAIR RADIO

136 VICTORIA RD., MARRICKVILLE

PHONE:
LA1604

PHONE:
LA1604

RED LINE

TRANSFORMERS of DISTINCTION

HIGH TENSION PLATE SUPPLY TRANSFORMERS

The units listed in this section are high tension transformers for full wave rectifier circuits. Valve heater windings are not incorporated as they are designed for use in amateurs' transmitters, large public address and paging installations, and many other applications where it is necessary to break the B positive DC supply line for "stand-by" operation.

ITEM 20. TYPE No. 27/600

Primary: 200-230-240v.	150 vA 50 cps
H.T. 600/500/500/600v. 250mA Choke Input	
Base: 5x5x4⅝" H	Wgt 13lb.
[illegible]	"S" is 2"

D.C. VOLTS	CHOKE INPUT
866	(A) 515v. (B) 415v.
5Z3	(A) 415v. (B) 310v.

ITEM 21 TYPE No. 27/880

Primary: 200-230-240v.	250vA 50 cps
H.T. 880/710/710/880v. 275mA Choke Input	
Base: 5x6x4⅝" H	Wgt. 18lb.
Mtng: V15	"S" is 3"

D.C. VOLTS	CHOKE INPUT
866A	(A) 765v. (B) 615v.

ITEM 22 TYPE No. 4/1250

Primary: 200-230-240v. 500vA 50 cps	
H.T.: 1250/1250v. 400 mA Choke Input	
Base: 6½x6x6½" H (app.)	Wgt 27lb..
Mntg:	Not shown
D.C. Volts	1000v. 866 Rectifier

ITEM 23 TYPE No. 4/1400

Primary: 200-230-240v. 575vA	50 cps
H.T.: 1400/1400v. 400mA	Choke Input
Base: 6½x6½x6L" H (app.)	Wgt 30lb.
Mntg:	Not shown
D.C. Volts	1250v. 866 Rectifier

CHOKES

The chokes covered in this section are tested under measured inductance values with rated DC flowing, as the meaningless "30 Henry" values are misleading to the uninitiated and ignored by the engineer. They are smoothing inductances for use as the first choke in condenser input systems, or of course, as the second choke for choke input circuits.
All inductances are sufficiently high for effective filtering, while DC resistance values are made low to maintain good regulation.

ITEM 24. TYPE No. [illegible]

Maximum Direct Current	60 mA
D.C. Resistance	400 ohms
Voltage Drop	24 volts
Maximum Inductance	25 Hys
Minimum Inductance	15 Hys
Base: 3¼x2x2¼" H	Wgt 1lb. 8ozs.
Mntg: MHI	"S" is 1"
Insulation	500V

ITEM 25. TYPE [illegible]

Maximum Direct Current	80 mA
D.C. Resistance	500 ohms
Voltage Drop	40 volts
Maximum Inductance	30 Hys
Minimum Inductance	18 Hys
Base: 3x3x2¾" H	Wgt 2lb 10ozs.
Mntg: V2	"S" is 1¼"
Insulation	750V

ITEM 26. TYPE No. 301214

Maximum Direct Current	125mA
D.C. Resistance	300 ohms
Voltage Drop	38 volts
Maximum Inductance	30 Hys
Minimum Inductance	12 Hys
Base: 3¼x3x2¾" H	Wgt 3lb 2ozs
Mntg: V2	"S" is 1½"
Insulation	750V

ITEM 27. TYPE [illegible]

Maximum Direct Current	175 mA
D.C. Resistance	200 ohms
Voltage Drop	35 volts
Maximum Inductance	25 Hys
Minimum Inductance	12 Hys
Base: 3¼x3x2¾" H	Wgt 4lb 4ozs.
Mntg: V14	"S" is 1½"
Insulation	1000V

ITEM 28. TYPE 102512

Maximum Direct Current	250mA
D.C. Resistance	100 ohms
Voltage Drop	25 volts
Maximum Inductance @ 10v AC	15 Hys
Maximum Inductance @ 80v AC	20 Hys
Full Load Inductance @ 10v AC	7 Hys
Full Load Inductance @ 80v AC	10 Hys
Base: 3¾x2 7-8x3½" H	Wgt 5lb 4ozs.
Mntg: V14	"S" is 2"
Insulation	1000V

ITEM 29. TYPE No. 5735

Maximum Direct Current	300 mA
D.C. Resistance	60 ohms.
Voltage Drop	18 volts
Maximum Inductance @ 10v AC	10 Hys
Maximum Inductance @ 80v AC	14 Hys
Full Load Inductance @ 10v AC	5 Hys
Full Load Inductance @ 80v AC	7 Hys
Base: 4x3 7-8x4" H	Wgt 7lb 12ozs.
Mntg: Not shown	"S" is 2"
Insulation	1000V

ITEM 30. TYPE No. 35215

Maximum Direct Current	15mA
D.C. Resistance	350 ohms
Maximum Inductance	30 Hys
Minimum Inductance	15 Hys
Base: 2x1 3-8" H	Wgt 8 ozs.
Mntg: MHO	"S" is 11/16"

ITEM 31. TYPE No. 294

Maximum Direct Current	1 Amp
Filament Choke	4 m/Hy
Base 2x1⅛" H	Wgt. 8ozs.
Mntg.: MHO	"S" is 11/16"

SWINGING CHOKES.

The swinging chokes in this section have the same general design and constructional features as the smoothing chokes above. Gap ratios, however, are modified on an incremental inductance bridge to develop large initial inductances, and at the same time, to maintain sufficient inductance under full load conditions to comply with the circuit requirements of high efficiency rectifier systems where the maximum possible regulation is required.

ITEM 32. TYPE [illegible]

Maximum Direct Current	250mA.
D.C. Resistance	100 ohms
Voltage Drop	25 volts
Swinging L is from 20 Hys to 5 Hys.	
Base: 3¾x2⅞x3½" H	Wgt. 5lb. 4ozs.
Mntg.: V14	"S" is 2"
Insulation	1000 volts

ITEM 33. TYPE [illegible]

Maximum Direct Current	300mA
D.C. Resistance	60 ohms
Voltage Drop	18 volts
Swinging L is from 15 Hys to 4 Hys.	
Base: 4x3⅞x4" H	Wgt. 7lb. 12ozs.
Mntg.: Not shown	"S" is 2"
Insulation	1000 volts

RED LINE EQUIPMENT PTY. LTD. TRANSFORMER ENGINEERS

DISTRIBUTORS:

VICTORIA:
Homecrafts Pty Ltd.
Arthur J. Veall Pty Ltd.
Radio Parts Pty. Ltd.
Howard Radio.
and all leading wholesalers.

NEW SOUTH WALES:
United Radio Distributors Pty. Ltd.

QUEENSLAND:
A. E. Harold,
B. Martin.

SOUTH AUSTRALIA:
Gerrard & Goodman.
Radio Wholesalers Pty. Ltd.
Newton McLaren Ltd.

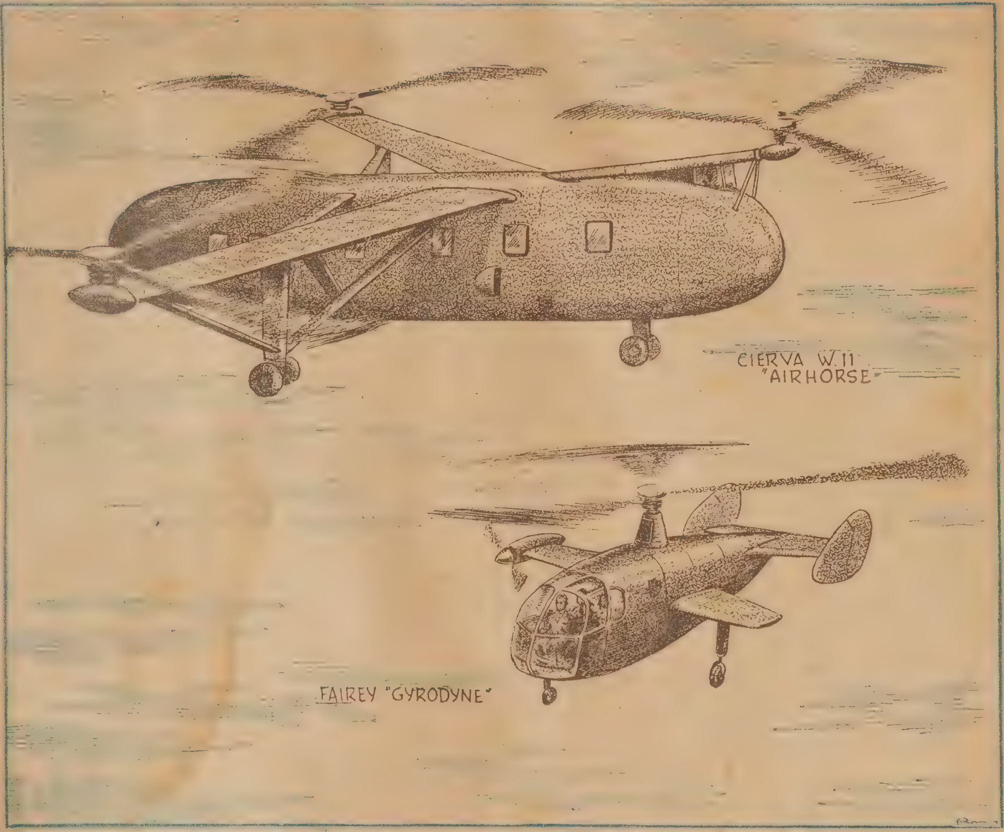
WORKSHOP: Cent. 4773.
2 Coates Lane, Melbourne.

CITY OFFICE: MU6895 (3 lines), 157 Elizabeth St., Melbourne.

Keep this Catalogue. Cut out and file for reference.

A GUARANTEE OF DEPENDABILITY

DESIGN IN BRITISH HELICOPTERS



Since it first appeared in practical form during World War II, the helicopter has "grown up" and "flying windmills" are appearing in a variety of styles. Development of the helicopter has been very rapid, and a number of American and British firms have programmes in hand for the mass-production of helicopters.

IT is visualised that before long "hover-planes" will be operating regular air-taxi services from pocket handkerchief fields for short, near-city flights.

Experiments undertaken by the British postal authorities in the use of helicopters for the carriage of mail were successful and in June a system of regular collection and delivery of mail by helicopter was inaugurated.

In the earlier stages, Britain lagged behind the USA in helicopter production, largely as a result of wartime concentration on fighter and bomber production, but some interesting new designs have now appeared and British firms are engaged in building them. Two of these are sketched here.

The Cierva W.11 "Airhorse" represents the greatest break with the previous "standard" helicopter design. For this type of aircraft, it is a giant, being designed to carry 24 passengers.

The "Airhorse" is something of a "cross" between the conventional aeroplane and the hovering, direct-lift helicopter. Unlike most helicopters, it has aerofoils as well as rotors.

The wings, which are of narrow chord, are swept back sharply. They spring from a point almost halfway back along the length of the fuselage in a high-wing arrangement.

Above the tip of each wing is a three-blade rotor. Halfway out, the wings each carry a "leg" on which is mounted a double landing wheel. The wings and "legs" are strutted for strength.

The third rotor is mounted on a bracket above the nose of the fuselage. The rotors together provide propulsive drive for both upward and forward movement.

The large fuselage is well rounded. The pilot's position is in an enclosed cockpit placed high and well forward.

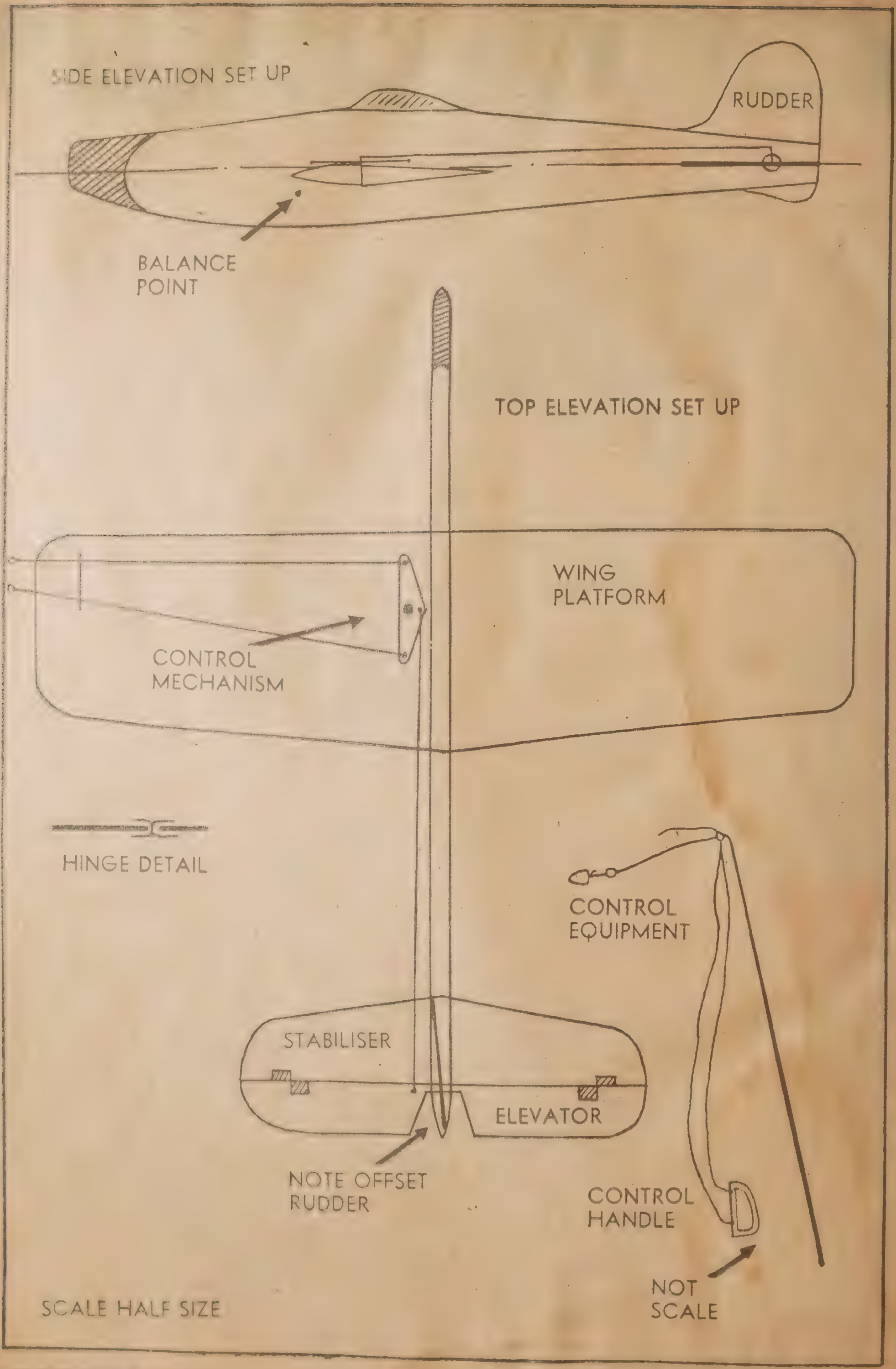
A double nosewheel in the base of the fuselage provides the third point for the fixed tricycle-type landing arrangement.

Air intakes for the internally-housed motors are located in the sides of the fuselage.

Payload of the "Airhorse" is set down as more than three tons.

The second of the helicopters, the

(Continued on Page 77)


SIDE ELEVATION SET UP
RUDDER
BALANCE POINT
TOP ELEVATION SET UP
WING PLATFORM
CONTROL MECHANISM
HINGE DETAIL
CONTROL EQUIPMENT
STABILISER
ELEVATOR
NOTE OFFSET RUDDER
CONTROL HANDLE
NOT SCALE
SCALE HALF SIZE

MAKE THIS SIMPLE SWING CONTROL

Here is a simple model which will give the constructor something a little more ambitious "to bite on" than is provided by a simple glider. Full diagrams are given on opposite page.

by Jack Finneran

YOU may remember that many months ago we described in these pages an article on swing control model planes. This is a somewhat similar project, but it is rather more ambitious in so far as it carries a likeness to the general lines of single-engine jet fighter planes. But more important still it gives the flyer complete elevator control.

The means of securing this elevator control is rather simple, but extremely effective and it allows the model flyer to perform numerous aerobatic manoeuvres while flying the machines in a circle around him.

We would like to mention here that you may convert almost any hand-launched glider to this form of controline flying, and provided that you increase the weight in the nose, you should be able to secure very excellent results from them.

This form of model flying is very much akin to and is excellent practice for the flying of the speedy diesel or petrol-powered controliners which are becoming so much a part of the model aeroplane flying hobby today.

Don't be deterred by any apparent complication of set-up, because with this model you really have a lot more latitude than with any other model so far described. Try to keep as close to the plans as possible. Don't worry overmuch about weight as it is not terribly important, but do make sure you have a smoothly-working elevator control.

The drawing is one-half scale, with the exception of the control handle lines, &c., which are just by way of explanation.

Use the old familiar cardboard template system and cut out the necessary assemblies as per drawing. You will notice that no dihedral angle is shown and none is necessary.

FUSELAGE CONSTRUCTION

We have used the profile type of fuselage again mainly because its depth affords sufficient strength for our purpose and again because while being simplicity itself, it bears a reasonable likeness to full-scale appearance when viewed from the side. We make it up per medium of our template from the hardest piece of balsa in stock.

Having cut out the shape required, draw a line through the centre and remove the wood where the wing goes through. Slot the rear to accommodate the tail section. The main consideration here is to keep these slots in line along the centre line of the fuselage, this is rather important if one is to secure smooth flying.

Smooth up the fuselage with successive sandings of medium and fine sandpaper until a nice smooth fuselage results. Give it two or three coats of dope and sand between each one so as to get a nice smooth finish to the fuselage.

WING CONSTRUCTION

Select a sheet of three-inch wide medium balsa and cut out the plan form of your wing, using your cardboard template as a guide.

This wing is made in a similar manner to a glider wing, with the exception that it has no dihedral angle. Using your coarse sandpaper, work the wing section as shown, into the flat balsa and finally finish with smooth paper and dope as per the fuselage. Try to duplicate the wing section if possible, as the correct airfoil, you will notice, is somewhat different from the usual section used on other strips and will help to give speed and stability in flight.

List of Materials Required

1 sheet 1¼" x 2½" hard balsa.
1 sheet ¼" x 3" x 12" medium balsa.
1 sheet 1-16" x 3" x 12" medium balsa.
1 small piece of 1-16" aluminium.
A small length of 22 SWG wire.
1 stick of modelling clay.
1 five to six ft. pole, bamboo for preference.
1 fishing eyelet.
Some 40 feet of light fishing line.
1 bottle model aeroplane cement.
1 bottle model aeroplane dope.
Miscellaneous equipment required will be a sharp knife, razor blade, pins and sandpaper.

TAIL PLANE CONSTRUCTION

Cut out the rudder section from your template, nicely round the corners, and smooth finish with dope and sandpaper in the usual manner.

We now come to the stabiliser and elevator sections. Great care must be taken here. You will first make the stabiliser section and then the elevator in the same fashion as the rudder. Having completed each piece separately according to the drawing it becomes necessary to join them together by means of a hinge.

We have chosen the cloth over-and-under variety as the simplest and most effective. Secure some ¼-inch wide tape or cut a strip of light, strong cloth into a strip of ¼-inch wide. From this strip cut off eight pieces, one inch long. Using the plan as your guide, cement the cloth strips in place so that each piece is reversed from its neighbor. For example, glue a portion of one strip on top of stabiliser, allow it to pass between the two pieces, and cement to the bottom half of the elevator. The piece immediately alongside is glued to the bottom of the stabiliser, passes between the two sections, and cements to the top half of the elevator. When this operation is complete, you will have a strong smooth working hinge.

The main assemblies being completed it behoves us to make the accessories which operate the controls.

Take a piece of aluminium, anything from 1-32in to 1-16in thick, and cut to the bell crank shape as shown. Drill the holes as shown, or punch them with a gramophone needle. Mount this on the wing in the manner shown on the plans and secure by cementing a piece of wire up through the wing and sandwiching the bell crank between two small washers. Bend the wire in a small loop on top of the crank or else solder the top washer to the wire. Don't make this bearing so slack that the crank rocks unduly, but see that it operates smoothly.

The lever which operates the elevator is also made by bending a small loop in a piece of wire, pushing it into the elevator at right angles and then cementing in place.

ASSEMBLY

Slip the ring through the fuselage and centralise it, adjust the stabiliser in place at the rear of the fuselage, and after having lined up these parts squarely with the fuselage, cement securely in place. You may now add whatever finishing touches you may desire and for once we will pardon you if you run riot with the paint brush. A little extra weight is useful rather than a hindrance because the plane flies mainly due to the centrifugal force generated when it is swung around above one's head.

Before attempting to fly the machine you must balance it near the leading edge of the wing. This is done by adding modelling clay to the extreme nose of the plane.

Having satisfied yourself that the balance is OK, and that everything is lined up squarely, you should get ready for flight.

(Continued on Page 77)

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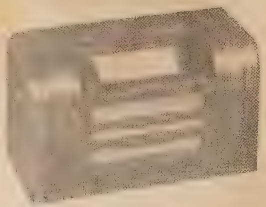

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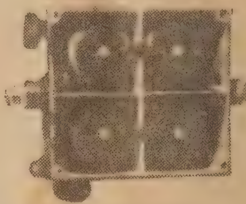

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MAKE THIS SWING CONTROL MODEL

(Continued from Page 75)

Join the bell crank to the elevator with the wire brace indicated on the drawing, fit the fishing eyelet to the rod to be used, and run two fishing lines out to the plane, passing them through the guide on the wing tip and tying them to the bell crank.

For your first flight use only about 12ft. lengths of line from the central handle to the plane.

The control handle to which the lines tie need only be a six-inch piece of wood which you hold in your left hand. Check the operation of the elevator by having a friend hold the plane, while you hold the rod in the right hand and the control handle in the left. With the lines from the handle to plane pulled tightly, the slightest movement of the left wrist should operate the elevators. You should now swing around in an anti-clockwise direction and at this moment your helper should release the plane, which should fly from his hands.

As you keep skinning around, the plane flies around you in a circle and you will, with practice, be able to fly level, climb or dive, and eventually, after plenty of practice, loop the plane.

All in all, a lot of fun is to be had from this comparatively simple controline model plane.

Design In British Heliocopters

(Continued from Page 73)

Fairey "Gyrodyne" (lower right), is a single lift-rotor type that shows some unusual features.

On each side of the fuselage a stub wing is placed halfway back in a mid-wing position. Mounted on the tip of the starboard wing is a small rotor operating on a horizontal axis which counteracts torque.

Landing "legs" carrying sprung wheels lead down from the wings and with the nossewheel provide tricycle-type landing gear.

The main rotor is mounted over the centre of the fuselage. It is driven by a motor located behind the passenger compartment. Air for the motor is drawn from the intake located in the front of the rotor mounting. Twin rudders are fitted to the tail unit.

Apart from the drawbacks associated with official bans under low-flying regulations, the main disadvantage so far encountered with helicopters has been the limited cruising range and the relatively high fuel consumption.

But there seems to be every prospect that in specialised fields the helicopter is likely to come in for increasing use. At present the high cost of the machines is contributing to limitation on their use, but this handicap may soon be overcome.

It would appear, however, that forecasts of the helicopter as "everyman's flying taxi" are still a long way from fulfilment. This is not due to technical difficulties, but is the result of the expensiveness of the operation of these aircraft.

THE JUNIOR EXPERIMENTER

(Continued from page 65)

E is in volts and I is in amps and R is in ohms.

These formulas, with due allowance for milliamp and megohm units, make it fairly easy to calculate the dissipation or heating effect which will be present in a resistor in any specific portion of a circuit.

The ordinary carbon resistor about $1\frac{1}{2}$in. long and $\frac{1}{4}$in thick is rated to have a maximum dissipation of 1 watt, while smaller and larger types of carbon resistor have dissipation ratings from $\frac{1}{4}$ to about 10 watts. The smallest wire-wound resistors will dissipate from 2 to 3 watts, rising in steps to 100 or more watts for the larger and more expensive types.

Where a circuit requires a particularly small resistor or, on the other hand, one capable of unusual wattage dissipation, the size is usually specified. Many resistors also are branded in terms of wattage while one can recognise the wattage of others quite readily from the general appearance.

WHY A RESISTOR?

One final point is to answer the question: Why use a resistor at all?

Without going into lengthy explanation at this stage one can compress the answer into two simple paragraphs. Resistors are used:—

1. To reduce an available voltage to a lower figure suitable to apply, for example, to valve electrodes.

2. To provide a "load" across which variations in current can produce variations in voltage.

These points are best illustrated by reference to the accompanying cirsuit which shows a resistor Rs in the screen circuit of a pentode valve and Rp in the plate circuit. The sole function of Rs is to reduce the available voltage, which may be around 250, to about 50 volts normally required at the screen under these conditions. The plate resistor is there purely to provide a load.

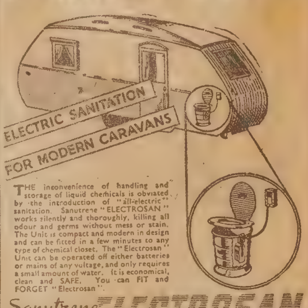
If the standing plate current is 0.5 milliamp, the drop across the $\frac{1}{4}$ meg plate resistor would be 125 volts, giving a plate voltage also of 125.

If an applied signal reduces the plate current to 0.4 milliamp the voltage drop across the resistor becomes 100 volts and the instantaneous plate voltage increases to 150—a variation of 25 volts. This variation in plate current with signal produces a variation in plate voltage across the load resistor and this can be applied by coupling a condenser to the grid of the following valve.

May be you wondered how we arrived at the foregoing figures. The answer is simple—we used Ohms Law which was introduced to you last month. Hence the saying "Ohm sweet Ohm."

Man-made earthquakes in the form of explosions can be detected 200 miles away with small, portable seismographs developed by the Carnegie Institution of Washington Scientists.

PUSH-BUTTON SANITATION



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PUSH-BUTTON SANITATION

Extract from Page 264.
"THE CARAVAN," October, 1947.
Electrosan Achieves High Standards.

The new Electrosan portable closet for Caravans and Aircraft has been given a very extended test by the Caravan covering about 2000 miles of towing. We used a model for 12 volt simply connected to the Caravan's electric circuit, which in turn was connected to the car battery. The high standard of personal comfort and sanitation achieved is best indicated by saying that a non-caravanner, accustomed only to water flushed town sanitation could be invited to use the toilet room without any qualms, or any idea that allowances ought to be made for the difficulties of portable sanitation.

The closet is electrolytic in action. The complicated organic nature of sewage is broken down by releasing some of the contained gas, probably oxygen; foaming round the electrodes reflects the rapid activity that is taking place. We lack the bacteriologist's or chemist's vocabulary in which to explain the process, but it certainly kills all smell and leaves the sewage as a thin smudge which pours easily and cleanly from the container.

Absolutely Inoffensive

In static use the closet is absolutely inoffensive, even if separated only by a thin partition from a larder. After towing when the upper sides of the pail had been splashed by the shaking a slight smell was discernible; not the objectionable lavatory smells, which are completely killed, but a rather sharp tang, which was best dispersed by giving the toilet room a short airing on arrival at the new site.

One asset of the closet is that you do not have to consider whether you are wasting chemical. You can tip as frequently as you like or as is convenient. Each use of the closet is neutralised at once by pressing the vacuum switch provided. The user can then go away and forget it; after a pre-arranged time period the closet switches off itself. The current consumed is quite small, and could probably be supplied by a heavy duty dry battery.

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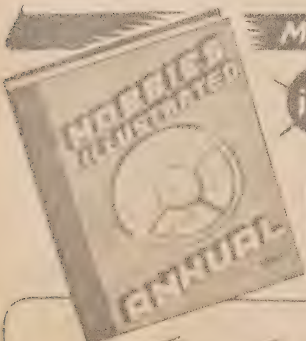

~~18/6~~

6/11

3. "Hobbies Illustrated Annual, 1946." Edited by Arthur Neville, this instructive volume combines all issues of Hobbies Illustrated from April to October, 1946. It contains a wealth of projects, hints, and tips covering chemistry, electricity, home and garden, microscopy, model making, photography, radio and woodwork. **Reduced to 6/11d. (post. 9d.)**

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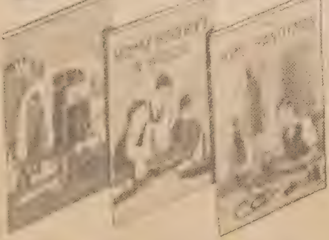

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THE ART OF FRENCH POLISHING

THERE are many ways of finishing wood, both to enhance its appearance and to protect it from the effects of wear and weather. These range from tar and bitumen to lacquers, enamel and french polish. The former certainly do a good job of protecting the wood, but they are far from decorative.

Enamels give a smooth, lasting finish for work that will be required to take a lot of hard use, but they do not show the grain of the wood. They are generally used on utility furniture such as kitchen chairs, tables, and other articles made from unfigured wood.

Clear lacquer is often used to finish medium quality veneered furniture. It usually wears well and is easily and quickly applied. It also shows the grain of the wood to good effect.

In the past, much furniture was hand-finished by the method known as french polishing. As this is a fairly lengthy process when compared with some of the other methods such as lacquering, it has been largely replaced in modern furniture factories. For small home workshop jobs, however, french polishing is probably one of the best methods. It brings out the grain of the wood better than most of the synthetic finishes, and has the additional advantage that it can be easily repaired should it be accidentally damaged.

POLISH
SPIRIT
RUBB

This picture shows the materials required for french polishing—spirit, polish, rubber and sandpaper.

Mass production in factories has made hand finishing a rare thing these days. This article tells you how to finish your woodworking projects in one of the best ways possible. Only a few simple everyday materials are required to french polish in your own home.

STAINING

The appearance of some light-colored woods is often enhanced before polishing, by staining them a darker color. Cheap woods can be made to look like more expensive wood by careful staining. Small scratches and faults in the wood are less easily detected if the work is suitably stained before polishing.

There are three basic types of stain. These are water, oil and spirit stain. Water stains have the disadvantage that they swell the grain of the wood, and in addition they take a fairly long time to dry. Oil stains take two or three days to dry properly, and are not often used for that reason.

Spirit stains are available in a variety of colors, dry quickly, and can be easily removed should too much be accidentally applied. Do not confuse spirit stain with the mixture often used to darken floors. This latter usually contains varnish, and is intended to give a glaze on its own account. Do not stain the wood to the color you finally require, as the polish will darken it slightly. If you accidentally apply too much stain, you can remove some by wiping with a rag dampened with methylated spirit.

Radio cabinets can often be made very attractive by staining different parts in different colors. A very popular type of console cabinet is made up of a sloping panel on which are mounted the controls and the dial. This panel is supported by two pillars, which may be stained a darker color than the rest of the cabinet. The skirt is usually stained black or a very dark brown.

The edges of speaker frets present something of a problem. One way to deal with them is to simply enamel them some dark color. Alternatively, they can be stained and filled, and the polish applied with a brush. The edges will require considerably more polish to produce a smooth finish than the rest of the job.

FILLING THE SURFACE

Some woods have an open grain which would take a long time to fill with polish. If not treated in some way the finished surface will appear pitted all over. The best method is to use a special filling compound.

A good filler can be made from whiting mixed to a paste with linseed oil and stained to about the same shade as the job. The filler is applied by rubbing across the grain. A pad made from scrap cloth is useful for this. The filler is allowed to set, and any excess removed with fine sandpaper.

by Maurice Finlay

The job is now ready to begin applying the polish. The polish consists of shellac dissolved in methylated spirit. It can be bought ready mixed or you can mix it yourself as desired. Some of the ready-mixed french polishes contain other chemicals for which special claims are made by the manufacturers.

The first two or three coats of polish can be applied with a brush in fairly rapid succession and allowed to dry. It is a good idea to leave about twenty-four hours before commencing the next operation. Before doing so the job should be rubbed down with No. 0 glass paper.

THE "RUBBER"

The work from then on is done with a "rubber." The rubber consists of a piece of soft cloth folded round a wad of cotton wool. The polish is applied to the cotton wool a few drops at a time and squeezed through the cloth by the rubbing action. When not in use the rubber should be sealed in an airproof container. This is to keep it soft. If you attempt to use a rubber after it has hardened in the air it will scratch the work.

The piece of covering cloth can best be an old handkerchief or a piece torn from an old sheet. If it has had a good many visits to the laundry so much the better. The reason for not using new cloth is that pieces of fluff

AVO

fine limits of

PRECISION

A. A1.

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Multi-range A.C.-D.C. 50 ranges. Indication on 5" hand-calibrated scale. Range selection is by two switches for A.C. and D.C. respectively — press-button gives additional range for each value of current and voltage shown on the switch knobs. An automatic overload cut-out is fitted to protect the instrument against misuse. The wide range, the type of measurement covered and small power consumption make this meter suitable for radio Testing and General Engineering. Accuracy is within B.S. first-grade limits.

Fine adjustment and correct testing call for the use of precision measuring instruments. The Avometer range is famous for fine precision and the ability to withstand rough usage without variation in fine limits of electrical measurement.

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HERBERT ST., ST. LEONARDS, N.S.W. P.O. BOX 29. CROW'S NEST. TEL: XF 1042 are likely to come off and stick to the work.

When polishing radio cabinets it is often a good idea to have two rubbers, a small pointed one for polishing the awkward corners and a larger one for the larger flat surfaces. The awkward corners are the parts usually neglected when polishing. You will usually find that if you take special care with the awkward spots the open parts will take care of themselves.

The rubber is prepared and charged with a few drops of polish. It is applied to the work by rubbing in a circular or figure-of-eight motion. The idea is to keep it moving. If the rubber is left standing on the work, even for a few seconds, it will leave a mark that will be hard to remove. When you have finished each rubbing operation the rubber should be taken from the work by sliding it over an edge. Do not stop and then lift it up.

The rubber is recharged by a few drops of polish which drip through a small nick cut in the side of the cork.

Allow the polish time to set between rubbing operations—a day if you can spare the time. Before beginning each operation, rub lightly with No. 0 glasspaper to remove any irregularities. Keep this process going until an even body of polish is applied to the work.

POLISHING

When this operation is complete the job will have a smooth, even finish; perfect except that it lacks shine. The process of polishing proper may now be commenced. This consists of gradually thinning out the polish applied to the rubber with methylated spirit. As the work nears completion the rubber is charged with practically pure spirit. The surface polish is partially dissolved, spreading it out evenly and producing the fine finish for which french polishing is famous.

This part of the work is the most critical. The job can easily be ruined by applying too much spirit and/or polish. The idea is to have the rubber just damp. If it tends to stick at any time during the work, a drop of linseed oil can be applied to the rubber. Only a small quantity will be needed.

(Continued on Page 89)

Remote Car Radio Dial 12/6

Speaker Cabinet, 6" 18/-; 8" 21/-; 12" 35/-.

Midget Motor, 3-6 Volt Actual size 10/9

Pyrox Spark Plug Suppressor .. .. 1/- ea.

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Gift Suggestions

That are Sure to Please

PICKUPS

The following pickups are types that can be thoroughly recommended and will give years of enjoyment when used in conjunction with your radio receiver.

FERROCART

The Ferrocart, although very reasonably priced, is a good quality crystal pickup. Its high output is an advantage on some of the smaller receivers.

49/6

B.T.H.

A well-constructed magnetic pickup of the conventional type. It is very rugged and will stand plenty of abuse. Fitted with volume control.

55/-

GOLDRING

A new arrival from Britain of the lightweight magnetic type. The output is ample for the average receiver or amplifier It is supplied complete with a sapphire tipped needle.

63/1

H.M.V.

Another new arrival. The lightweight HMV magnetic is rather unusual as regards its frequency range, considering its high output. Frequency is substantially flat from 50 to 8000 c/s and its output at 10 K/c is still quite useful. It is supplied with a matching transformer and the output is sufficient for most radios and amplifiers.

99/6

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Something new. A moving coil pickup at a reasonable price. Response is flat from 250 to 12,000 cycles. With sufficient bass boost to increase the low note response, excellent results can be secured from the new wide range recordings. A preamplifier is desirable. Supplied with matching transformer.

97/6

TOYS FOR BOYS

JUNEERO

This is better than the usual toy as it enables many small repairs round the home as well as the construction of unlimited metal toys. The metal is cut, punched and bent with a special tool and then assembled.

Juneero No. 1 Set	49/6
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The original British construction set.

No. 0	10/3
No. 1	16/-
No. 2	£1/1/3
No. 3	£1/11/-
No. 4	£2/3/6
No. 5	£2/19/6
No. 6	£4/0/3
No. 7	£5/19/0
No. 8	£10/1/6

DINKY TOYS

The famous miniature scale models—available in a wide range of cars, trucks, etc. All replicas of the real vehicles.

Cars	2/1 to 4/1
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Ambulance	3/3
Double Deck Bus	4/8
Jeep	4/1

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Meccano Clockwork Magic Motor	8/-
Electrotor 3 to 6 volt Midget Motor	8/6
Electrotor 3 to 6 volt Midget on Support	10/9
Electra 3 volt D.C. Motor	23/6
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YORK KITSET

You can save money by buliding this efficient 4-valve set. The brown moulded cabinet with special perspex dial is very modern and the size is only 10¾" x 6¾" x 6¼". The complete kit includes 5" Rola Speaker, 6J8G, 6G8G, 6V6GT and 6X5GT valves, all small components, wire, screws, etc., and complete instructions.

£13/13/-

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An extension speaker is always useful and now is the time to buy while a reasonable range is available

KINGSLEY

Special extension speaker. A KR6 6" unit housed in attractive metal case, with on/off switch. Can be used on a shelf or hung on the wall.

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KR6 6" speaker complete with either 5000, 7000 or 12,000 ohm transformer.

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ROLA

Type 8K 8" Permagnetic with 5000 or 7000 ohm transformer.

38/11

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Reduce that electrical interference by putting in an RCS Line Filter. Simple to instal and very effective.

27/-

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Why not save money and build your own multimeter. We can supply the parts for most types.

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Selected 2 pc voltage multipliers, ea.	1/6

We take this opportunity of wishing our many friends the Compliments of the Season and trust that the New Year will give you the best in radio

PRICE'S RADIO

5 & 6 ANGEL PLACE, SYDNEY

THE SERVICEMAN WHO TELLS

(Continued from Page 47)

tent B battery. The annoying part of this item of service was that the set ran for over a week on the test bench without showing up, not to mention a long ride in the truck."

Again it is many thanks for an interesting letter. Just by way of conclusion I might mention a receiver in my own district, which gave its owner a lot of trouble with intermittent noise. He had erected a good outdoor aerial system, installed an earth wire and tacked the power cord neatly along the skirting board to prevent it trailing on the floor. It did not take me long to discover that the noise was due to a loose aerial terminal which was not only making poor contact with the solder lug inside, but was also allowing the strands of the aerial lead to brush against the chassis. Worst part of this call was that I had to pull the chassis out of the cabinet before I could tighten down the terminal and restore order.

Speaking of terminals my mind flashes back to my very first job in a radio factory. Close by there was another young fellow whose particular task in life was to part-assemble the chassis, including the installation of aerial, earth and pick-up terminals.

I agree that terminals are finicky things for the most part. If you put too much pressure on the nut, the thread strips or the whole device falls apart. Alternatively, if you do not tighten them sufficiently, the terminal comes undone at the most inappropriate time. And our young friend always erred on the side of laxity, despite repeated warnings from wirers and testers who had subsequently to handle the chassis.

In desperation one of the wirers decided on a lesson which young A—— would never forget. Keeping his clever scheme to himself he cross-connected the high tension secondary on the power transformer to a loose pickup terminal. A mains lead was surreptitiously added and pushed into the power point.

When the stage was set the assembler was brought over and advised loudly on his wrong doing. Taking up the challenge he gripped the chassis firmly with one hand and went to work on the terminal with the other. In the ensuing moments he displayed surprising agility and eloquence.

The point was certainly impressed, but I am still wondering why we didn't have dealings with the medico or coroner. Boys will be boys!

The Vast Chemistry of the Sea

(Continued from Page 13)

In this case the waste product is spent sea water and it is obvious that, owing to the enormous quantity of sea water treated, this spent water cannot be discharged back into the sea near the intake which supplies the fresh salt water to the plant. Such a dilution would reduce the amount of bromine salts in every gallon of water.

This problem is usually overcome by erecting the plant after studying the currents of the sea, the discharge of fresh water from rivers, and the rainfall. The plant is erected so that the spent water is carried away by currents below the point of intake.

The rapid rise of the magnesium metal industry is one of the industrial romances. The production of the metal in America has risen from 39 tons per annum in 1915 to about 275,000 tons at the present time.

The use of magnesium increased enormously during the war for use in aeroplane manufacture and further use has been found for the metal in special alloys requiring lightness and durability. Magnesium is the lightest metal known, is hard wearing, and strong.

The most successful process for its production is electrolytic, using sea water as a base.

Magnesium is contained in sea water to a concentration of about 0.14 per cent. or about 4,000,000 tons per cubic mile. Some minerals found in the earth contain 300 times as much, but nevertheless the sea is the most economical source as all the materials required, except possibly the electricity, are also products of the sea.

The magnesium is recovered from the magnesium salts by a process which converts the salts to magnesium oxide, which is finally reduced electrolytically to the pure magnesium metal.

Of the non-metallic elements present in sea water, iodine is one of the scarcest. Yet the sea can be said to be truly a source of this important element inasmuch as sea weed is very rich in it.

The iodine from sea weed industry has had a very varied history, but nevertheless sea weed still forms a most prolific source of the world's iodine supply.

Kelp contains about 40lb. of iodine per ton. It is recovered by extracting it from the weed by water, subsequently treating the extract with various chemicals to free the iodine from impurities.

The fastest bird know is the swift, some species of which fly at an estimated 200 miles an hour.

* * *

About 20,000 tons of steel are used every year in the United States of America to make motor car licence plates.

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PORTABLE GRAMOPHONES
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Luxury cabinet of revolutionary design, finished in black brocaded, imported leathercloth, equipped with imported S/spring motor, full-tone de-luxe sound-reproducer, exponential metal sound-chamber, two locks, corner-needlecup, self-adjusting lidstay, glorious reproduction.

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KNOW HOW, NOW!

LEARN THESE AMAZING SECRETS AT HOME FROM INSTRUCTIONAL FOLIOS.

CONCENTRATION: Don't work or play with half a mind. Successful persons use most and geniuses use all. We each have one brain only. Learn how to use yours and ensure certain success, 2/6

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MENTAL TELEPATHY: Transmit and receive unspoken thoughts. Some knowledge has at last been learned of this sixth sense. This revelation tells you how to achieve remarkable results. .. 2/6

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SHORT WAVE NOTES BY RAY SIMPSON

CHANGES IN NEAR EAST STATIONS

MOVE TO MALTA AND CYPRUS

The troubled conditions in the Near East countries has had its effect on the Broadcasting activities of quite a number of stations quite apart from the many new ones which have taken the air. Most of the new ones have been operated by the new state of Israel and we have refrained from mentioning any of them until such time as they settle down to regular schedules and frequencies.

T[illegible] which [illegible] from [illegible] JCKW, [illegible] island of [illegible] and is [illegible] early [illegible] information [illegible] Australia [illegible] cast to [illegible] litania. Major Leslie Knight [illegible] Officer-in-Charge FBS, Headquar[illegible] W [illegible] programmes of [illegible] that [illegible] the 25-metre [illegible] station will [illegible] logged in Australia by the [illegible]

[illegible]y of our readers have already re[illegible]d their verifications from the Near [illegible] Arab broadcasting station when it [illegible]d from Jaffa and they will be interested to know that the station has [illegible]ved to Cyprus, and, according to [illegible] chief engineer of the station, Mr. A. W. Dean, they will commence operations on November 1, using a power of 7½ kw after an initial testing period on low power. Their schedule is given as 1.35 pm to 4.35 pm on 6.135 mc, 6.17 mc and 9.65 mc; 8.35 pm to 1 am on 6.17 mc, 9.65 mc and 11.72 mc; and from 1.45 am to 6.15 am on 6.135 mc, 6.17 mc and 9.65 mc. News at dictation speed in Arabic can be heard at 2 pm, 3.30 pm, 4 pm, 2 am, 2.15 am, 4.30 am and 4.45 am. Their new address is given as PO Box 219, Limassol, Cyprus.

These two stations, operating in Malta and Cyprus, will enable most listeners to add another two countries to their list as previous to this the only stations heard from these islands were amateurs, and then only very infrequently.

While speaking of stations from this part of the world, we note from Radio Australia DX session that Radio Kol-Israel has adjusted its frequency to [illegible] mc and the new call letters are 4XA21 on 18.89 mc, 4XB21 on 18.35 mc and 4XC21 on 14.702 mc.

FULL SCHEDULE FOR RADIO MALAYA

THROUGH the courtesy of Graham Hutchins, of Radio Australia, we are [illegible] give you the full schedule of Radio Malaya, both for the Singapore stations and also those located on the mainland. This schedule also contains the broadcast band frequencies, which, although not of interest to short-wave [illegible] may be of use to those of our [illegible] DX on their broadcast [illegible]

SINGAPORE.

Blue Network: Malay and English

2.30 pm to 3.30 pm: English, 620 kc and 7.2 mc

3.30 pm to 4.30 pm: Malay, 620 kc and 7.2 mc

SATURDAY AND SUNDAY

4.30 pm to 5.30 pm: English, 620 kc.

6.30 pm to 8.30 pm: English, 620 kc and 6 135 mc

DAILY

8.30 pm to 10.15 pm: Malay, 620 kc and 4 825 mc

10.15 pm to midnight: Malay and English, 620 kc

Midnight to 1 30 am: English, 620 kc, 4 825 mc, 1.985 mc.

Sundays to 2 am: On the same frequencies.

Red Network: Chinese and Indian

DAILY

2 30 pm to 3 15 pm: Chinese, 1330 kc and 6 135 mc

8.30 pm to 10.15 pm: Chinese, 1330 kc.

10.15 pm to 11.30 pm: Chinese, 1330 kc and 4.78 mc.

11.30 pm to 1.30 am: Chinese, 1330 kc and 4.78 mc.

KUALA LUMPUR

3.30 pm to 4.30 pm: English, 1013 kc, 1203 kc and 6.025 mc

10.45 pm to 1.30 am: English, 1913 kc, 1203 kc and 6.025 mc.

10.15 pm to 12.45 am: Malay, 6.025 mc.

2.30 pm to 3.45 pm: Chinese, 1203 kc.

10.15 pm to 11.30 pm: Chinese, 1203 kc.

5.30 pm to 6 pm: Chinese, 1203 kc and 6.025 mc.

PENANG.

3.30 pm to 4.30 pm, 10.45 pm to 1.30 pm: English, 1280 kc.

[illegible] pm to 3.30 pm, 10.15 pm to 10.45 pm: Malay, 1280 kc.

2.30 pm to 3.45 pm, 8.30 pm to 11.30 pm: Chinese, 1110 kc.

MALACCA.

3.30 pm to 4.30 pm, midnight to 1.30 am: English, 1073 kc.

8.30 pm to 9.30 pm, midnight to 1.30 am: Malay, 1073 kc.

10.15 pm to 11.30 pm, midnight to 1.30 am: Chinese, 1073 kc.

(The news in Chinese is relayed from Singapore at 10.15 pm and also at 11.15 pm.)

It should be noted that all Radio Malaya transmitters are on the air Sundays from 11.30 am to 2.30 pm.

It is hoped to give the schedule of the British Far Eastern Broadcasting Service in Singapore in an early issue as these stations are being heard quite well on 6.77 mc, 9.69 mc, 11.85 mc and 15.3 mc.

SHORT Wave Notes for the January issue are due on 11th December. For the February issue they are due in January 8. Please send them direct to Mr. Ray Simpson 80 Wilga Street, Concord West. NSW.

NEW STATIONS OF THE MONTH

COLUMBIA.—This month we have three new stations in this country, the first two being owned by the same organisation. These stations use the slogan, "Emisora nuevo mundo," and operate as HJKB on 6 mc and HJKF on 9.52 mc. The location is Bogota, and they are both being heard in New Zealand till closing at 2 pm. According to the Swedish DX bulletin, there is also another outlet on 6.165 mc and an FM transmitter, these latter two stations using the calls HJKJ and HJKFM.

Another Bogota station being heard well at the present time is HJCQ on 11.68 mc, which, according to Ern Moore, of Brisbane, puts in an excellent signal from around 1.15 pm with music and announcements in Spanish, then three chimes are given at 2 pm and the station leaves the air at 2.15 pm with the playing of a march.

INDIA.—Although the stations operated by All India Radio already have a great number of channels in practically all short-wave bands, they are evidently still looking for new outlets as we have reports from both Art Cushen and also Ern Moore that VUD Delhi has been heard at excellent strength operating on 9.56 mc and also 11.76 mc. The programme is in English so no difficulty should be experienced in logging them on these new outlets.

According to the NZDXTRA, they have also been testing on 9.68 mc and 15.13 mc in chain with the other two channels. We are awaiting word from the station authorities as to whether these are actually new transmitters or just additional outlets of any of the existing VUD stations. We hope to be able to give the actual call letters of these stations in our next issue.

ECUADOR.—For some time now we have had word of the well-known Quito station HCJB taking into use a new channel in the 16-metre band. This new outlet is now on the air and has been heard both in Australia and also in New Zealand, while previously it had been logged and verified in the USA. They are using a frequency of 17.89 mc and are on the air Tuesdays to Fridays from 6 am to 7 am, using English, Swedish, Spanish and the French languages, the English being used on Friday.

They should easily be recognised as their slogan, "La voz de los Andes," would sound very similar no matter what language was being used. They are transmitting on a provisional permit from the Ecuadoran Government and, if the reports of reception are satisfactory they will ask for permission to use this channel for regular transmissions to Europe.

MISCELLANEOUS. — There is another new outlet for the well-known Shepparton stations used by Radio Australia, the new one being VLA11, which operates on 9.58 mc from 4 pm to 4.45 pm with a programme directed to Europe. This session is in French and replaces that formerly heard over VLA8 on 11.76 mc. Arthur Cushen tells us that he is hearing KCBR on a new frequency, 6.18 mc with the Voice of America programmes from 7 pm and in addition the same programmes are being heard over some of the BBC outlets, namely, 7.2 mc and 9.825 mc, the former evidently being a new channel.

Dorothy Sanderson was the first to advise us that the British Far Eastern Broadcasting Service in Singapore was now being logged nightly on 11.85 mc, while Ern Moore confirms our own listening by reporting what is almost certainly 2YK3 Recife, Brazil, on 9.565 mc from around 6 am. It cannot be heard, of course, until the Delhi station on 9.56 mc leaves the air at that hour.

FLASHES FROM EVERYWHERE

MALAYA.—In the September issue we mentioned having written to Radio Malaya regarding their omission to specify which particular station was verified, and we have now had a very courteous reply from the Director of Engineering. As his reply is of interest to all listeners we are printing it in full. "Many thanks for your letter on the subject of Verification Cards, and we find the information extremely constructive. Quite frankly, due to the fact that we are short of staff and in the throes of heavy studio and transmitter installation, we have been unable so far to pay the required attention to our non-Malayan listeners.

"Shortly, however, it is hoped to organise engineering replies on a full-time basis and a comprehensive identification card such as you suggest will certainly be adopted. Regarding call signs, our function at present is to supply a service for Malaya only and identification other than "Radio Malaya" has not been considered necessary. Our short-wave transmitters in Singapore are directed toward Penang and main programme items are re-radiated by our local stations all of which to date are situated on the west coast of Malaya."

It is very gratifying to find a station taking such an interest in their listeners' suggestions, and we must compliment "Radio Malaya" on the attention they propose to give to reports from their overseas listeners.

NORTHERN RHODESIA.—In a recent letter from station ZQP they sent us their schedule, and we were struck by the number of dialects used in their broadcasts. How many of us for instance could tell the difference between Chibemba, Chinyanja, Chitonga, Silozi, Sindebele, and Chisona? all of which are used on different days of the week in addition to their English sessions, which incidentally are on Wednesdays and Sundays from 1 am and also on Sundays at 7 pm to 8 pm and on Mondays from 1.30 am to 2.15 am. Their programmes include such items as Chippys Dance Band, Silozi talk, "The Military System of the Amandebele," Tonga songs sung by Phiri's Choir, and on Sundays they have African hymns and other religious music.

EL SALVADOR.—It is very seldom that we have any reports of hearing stations in this country, although our friends in New Zealand manage to log them when conditions are favorable. One of the most consistent of the El Salvador stations is YSUA, which transmits on 6.25mc with a power of 1 kw, and uses the slogan, "Radio Mil Cincuenta." According to a letter received from the station by a Swedish listener their schedule is from 4 am to 7 am and from 11 am to 3 pm. It may be possible to log this one around 6.30 am, but our suggestion would be to wait for a day which was free from static and try to log them just before they close at 3 pm. If you should be lucky, send your report to Radio Mil Cincuenta, La Avenida Sur No. 50, Salvador, El Salvador.

BRAZIL.—Our older listeners will remember the difficulty which has always been experienced in obtaining verifications from "Radio Nacional," which transmits through PRL7 on 9.72mc, PRL8 on 11,72mc, and PRL9 on 17.85 mc from the capital, Rio de Janeiro, using a power of 50kw. Some American magazines stated that the station would verify if reports were sent in Portuguese, but, although we sent one in this language we have so far not been successful. It is very nice to learn, therefore, from the Universalite, that at least one listener in the USA has received a verification in the form of a letter in Portuguese signed by the general manager, Mario Neiva. Those who are still awaiting verifications should, therefore, not give up hope.

FRANCE.—From the latest issue of the Universalite we have news of test transmissions being carried out by the Paris short-wave stations. At the time they went to press the information was that these test broadcasts had been heard on 15.295mc from midnight to 3 am, and on other days at the same time on 15.1mc. From 6 am to 7 am they were heard on 9.56mc, and also at the same times on 11.845 mc. It is understood that these tests were being conducted as a preliminary to broadcasts of United Nations sessions when that body meets in Paris. Reports were requested and were to be sent to Boothe, UN Services, Palais de Chaillet, Paris 16, France. Perhaps some of our listeners have heard these transmissions.

SPAIN.—The Spanish stations have always been a little difficult to identify as they quite often go in relay with Radio Nacional de Espana in Madrid, which, of course, makes it a trifle confusing. There is another Madrid station known as "La Voz de la Falange," which has an assigned channel of 7.38mc, but which has been reported as being heard quite well on its harmonic of 14.76mc.

According to the station representative in England, this station will verify all correct reports and send them by air mail, so have a listen for this one around 7 am either on 7.38mc or their harmonic, 14.76mc, and see if you can obtain enough to send for a verification.

NEW STATION LOGGINGS

Call.	KC.	Metres.	Location.	Time Heard.
HJKB	6000	50.00	Bogota, Colombia	2.00 pm
KCBR	6180	48.54	Delano, Cal., USA	7.00 pm
HJKF	9520	31.51	Bogota, Colombia.	2.00 pm
VUD	9560	31.38	Delhi, India.	5.30 am
ZYK3	9565	31.36	Recife, Brazil.	6.00 am
VLA11	9580	31.32	Shepparton, Vic.	4.00 pm
HJCQ	11680	25.68	Bogota, Colombia	2.00 pm
VUD	11760	25.51	Delhi, India.	5.30 am
BFEBS	11850	25.32	Singapore, Malaya.	9.00 pm
HCJB	17890	16.76	Quito, Equador.	6.30 am

NEW BBC MOBILE RECORDER

THE BBC has designed a special mobile recording unit which made its first appearance at the Olympic Games. It carries eight miniature magnetic recorders which can make eight separate recordings, of up to half an hour continuous running, at the same time. This unit is intended for use on occasions when several commentators wish to record, in different languages, eye-witness commentaries on an event, for subsequent transmission to different countries at convenient times. The recordings can be played back immediately, without any preliminary processing, and can be checked for faults during the recording.

The apparatus, mounted on a 15cwt Morris chassis, is operated by two engineers, who maintain the equipment and load the eight recorders. These engineers are in immediate touch with all the commentators (who may be spread around the van at distances up to 300 yards away) by green light signals and two-way speech—in which the microphone can be used as a loud speaker, so that headphones are unnecessary. In addition to speech and cue circuits, the multicore cable to each microphone carries a circuit by means of which each machine can be started and stopped by the commentator, who has merely to press a button on his microphone handgrip. The commentator is warned when his machine is in operation by the shining of a red light, built into the grip and just below the microphone.

Judicious use of the starting switch can make it possible for a half-hour spool to contain all that is worth describing of an event which may take much longer to unfold itself. This method also has the virtue of concentrating all the speech, without leaving long gaps on the spool, making the subsequent process of editing and dubbing more simple.

When the unit has operated at a distance from its base, the recorders can be used to reproduce the spools by ordinary telephone, for direct insertion into transmission or for recording at the base. For convenience, the van has large built-in drums, each carrying 100 yards of multicore cable to provide speech, cueing, talk-back and operating circuits for four machines.

ENGLISH BY RADIO—POPULAR SESSION

THE following article is published in the BBC London Letter and will be of interest to all listeners who have heard this session from their stations.

"A successful experiment in the use of radio to teach language is now five years old. 'English by Radio,' first appeared modestly in the BBC's European service on July 4, 1943. The general theme of the programme was that the Allied forces when they landed in Europe would need help and guidance, and it took the form of interviews between an English speaking soldier and an inhabitant of an occupied country. These early programmes were broadcast under difficulties. There had never been any comparable broadcasts on which to draw for experience; the programmes were addressed to an audience of all European nations, and had to be entirely in English, for it was not possible to explain them in a score of languages. Above all they had to be worthwhile, because their audience was risking death and torture by listening to the BBC.

Since then "English by Radio" and its audiences have greatly expanded. Each programme is now broadcast to different parts of Europe in turn three or four times a day. Another series goes to the Far East, and will soon be extended to Africa and Latin America, while some programmes will be recorded and sent out to other lands and broadcast there. In the European service there are now advanced as well as elementary lessons. Apart from programmes in English only, specially written lessons with explanations in foreign languages are now broadcast to Austria, Albania, Bulgaria, Czechoslovakia, Denmark, Finland, France, Germany, Greece, India, Holland, Hungary, Norway, Persia, Poland, Portugal, Rumania, Russia, Spain, Turkey, and Yugoslavia (with Slovene and Serbian editions).

"English By Radio" does not claim to replace other methods of teaching the language, but gives listeners a chance to get easily a working knowledge of spoken colloquial English. Certain days of the week are given to different aspects of it, ranging from elementary conversation and practice in pronunciation to advanced reading and talks on dialects. Perhaps the most popular features are the 'Brown Family,' from whom listeners hear how English is spoken and life lived in a typical middle-class household. These families have been welcomed as personal friends in millions of homes abroad and have proved the effectiveness of radio as a means of increasing international goodwill.

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THE HAM BANDS WITH BILL MOORE

Most of the signals personnel left the Services after the last war with the general idea that they had seen the last of telegraphy as a means of communication in war and that the art of "Brass pounding" was rapidly fading.

A RECENT statement by the Director of Communications of the USAF (Major-General Ankenbrandt), throws the latest light on the subject.

To quote: "No technical advances have eliminated the need for the manual radio operator. To date, we have no automatic method that can in size, weight, frequency, economy and simplicity, compare with CW telegraphy; we have no method which will discriminate against accidental or intentional interference to the extent possible with a trained operator. There is no electronic substitute for an operator's brain.

"We in the Air Force have many communications circuits which operate under marginal conditions; under such conditions the additional flexibility, simplicity and reliability of a CW circuit frequently means the difference between having communications and not having them.

"When we can use them, we will employ the latest advancements in radio communication including radioteletype, facsimile and television techniques; in the foreseeable future, however, we see no replacement for the manual radioteletype operator in the field for which he is peculiarly adapted."

The General's statement displaces any ideas we may have towards the demise of CW. In the US, there seems to be a general movement towards the tightening of regulations, to ensure increased telegraphy activity. A Morse standard of 16 wpm for Class A licences is to be enforced, besides the probationary period.

Of the amaters who immediately operate on telephony, there seems to be two sections, those who had difficulty in mastering the code — it is a problem to many — and those who prefer it; that is excluding the few who think they can better make their presence felt with the aid of a microphone.

Increasing telephony activity means increased interference problems, especially evident in this country, where we have no separate telephony and CW allocations. Improved technique may assist, SSSC may even be the solution, but the mass of equipment necessary at the moment would put it out of the reach of many.

CW is with us for a long while yet, and it appears that it will become even more popular in the future as a method of fitting more stations into any given space.

GENERAL conditions during the four week-ends of the DX test didn't treat the entrants too kindly, and to add to the trouble, static was quite heavy during the first two week-ends. Overseas activity was considerable, a few W complaining of lack of advance publicity. Even if by some miraculous act a copy could be handed to the world's 100,000 amateurs personally, we would still have the chap who didn't have time to read it.

Some choice prefixes were prominent—IS, MB9, CZ, VPI, HP, C (Formosa), YJ, &c., and most participating stations added a few new countries to their list, C3EA, W6DI and KP6AA supplying tremendous signals to the telephony section.

Of interest was the fact that European stations were contacted the long way round, on 40MX. A number of G and F's were heard and worked about 1700 hours E.A.S.T.

Scoring well in the open CW section in NSW was VK2RA; in the 20MX CW section VK2DG, 2ZC, 2TF, 2VN, 2XU, 2DA, 2VA; in the 10MX CW section 2YL.

The 20MX telephony section resolved itself into a battle between VK2AHA and 2US, who finished close together. Reputedly 7AZ is out in front. 2FH, with his four-element, wide-spaced 20MX beam, was also to the fore.

VK2EO, CW winner for the two previous years, ran up 200 contacts in five hours, just to keep his hand in. 2RA made 38 contacts in an hour, and 2TF 26.

Some of the entrants stated they preferred the old 48 hours of operating, but the general concensus was in favor of the selected 24 hours in each week-end, even considering that their selection of 24 hours might not be as favorable from a conditions aspect as others.

The contest committee of the NZART, who check the logs, have a job ahead of themselves, and full scores will appear in "Break-In," official organ of the NZART, and "Amateur Radio" organ of the WIA.

RADIO CLUB NEWS

THE Experimental Radio Society of NSW meetings for December will be held on the 9th and 23rd. They have new club rooms, the address, Greenwood Hall, Liverpool Road, Enfield, and the transmitter will shortly be set up, using callsign VK2LR. The secretary, Mr. B. Taylor, would be pleased to hear from any intending members in the Western Suburbs.

WOY WOY has been selected as the location for the NSW Division's 1948 Field Day, the date December 5. Is is hoped to see in attendance a large representative gathering of amateurs from Sydney and the Blue Mountains. to as far north as Taree.

Assembly time is at 11 am; lunch 12.30 pm; hidden transmitter search and launch trip for the YF's, YL's and kiddies at 2 pm; reassemble 4.30 pm; tea 5 pm.

The "Hidden" Transmitter will be operated on 144mc, the antenna vertical for all-round coverage. Competitions and prizes for all. The arrangements are in the hands of Cec. Hardman, VK2KR, of Woy Woy — make the Field Day a MUST for December.

STANDARD FREQUENCY TRANSMISSIONS

THE Victorian Division of the WIA has taken the initiative in organising check frequency transmissions. These transmissions will take place on the 7000kc band and should prove invaluable to VFO users throughout the Commonwealth. Checks will be given on spot frequencies every 10kc from 7000 to 7200kc. VK3WI will next give these transmissions in January, the date to be announced later.

UHF CONTEST

THE NSW Division's UHF test is progressing well, and holding the interest of the UHF crowd. Some sporadic E, as mentioned elsewhere, helped the scores along on 50mc.

After the first month scores were approximately as follows: 50mc—VK2LY 466, VK2RU 461, 2WJ 260, 2ADT 257, 2BZ 150; 144mc—VK2ABZ 265, 2WJ 260, 2LZ 260; 288mc—VK2ABZ 31, 2LZ 27, 2WJ 23.

VK2AH and 2VW, among others, are scoring well, but no other scores are available.

Two points in the rules have been clarified by UHF officer Chas. Fryer, VK2NP. The first, that, although three bands can be used in the open section, it is not necessary to operate all three bands to enter in the open section. Any combination of two will do—288 and 50mc, or 144 and 288mc, &c. The third band, of course, gives a valuable multiplier.

The 24-hour period between contacts is based on midnight to midnight. Actually, one contact per day, not 24 hours actual time between contacts.

THE NSW Division suffered a loss on the retirement of their secretary, Wal Nye, VK2XU. He took over the position at a very difficult time, and in 12 months saw the membership increase by 150. Wal, as an accountant, was well qualified, and did an extremely efficient job. Active since 1934, he was with Signals in the last war, and the Division is fortunate to be able to retain his services in an advisory capacity.

Dick Dowe, VK2RP, lately assistant-treasurer, is the new secretary; he has been keenly interested in WIA affairs for some years, and looks forward to the co-operation of members during his term of office. NSW WIA meeting for October was attended by 120 members, who listened to an instructive lecture by Ray Priddle, VK2RA, on "Break-in Control."

A humorous interlude was provided by the lecturer, who announced that formal dress would in future be worn for WIA lectures. Would-be lecturers were relieved, when Ray departed, before the closing, arrayed in tails, to attend another function.

The remainder of the meeting was spent on a general discussion of WIA affairs.

To relieve councillors of the ever-increasing burden of additional duties, the Division has arranged to call more members to assist in general duties. Sub-committees will be formed to this end.

Council member, Lee Cuffe, VK2AM, will now be responsible for the distribution of the monthly bulletins, and will draw the required assistance from members in the Mosman district.

VK2YP, Clive Hutcheson, has been appointed social officer. He, too, will call on members for assistance.

Another sub-committee to be shortly formed will make the preliminary organisation for next year's country convention. Technical Officer, VK2ZH, Naughton Macnaughton, has taken over much of the administrative work from the Class Manager, leaving him free for instructional duties.

These changes should do much towards eliminating administrative problems.

THE UHF'S

THE various US stations who have been competing for a WAS on 50mc can rest a while, as both W9ZHB and WOZJB have earned a certificate for contacting the 48 States. W6UXN and WOUSI are close by, with 47 each.

The US summer did not treat the UHF gang too well. Single hop contacts up to 1400 miles were reasonably plentiful, but no two-hop contacts were recorded. The first time on record since 1935. Bending on 144mc took place at one stage or another over the whole continent. W8WJC has contacted six call areas on this band, W2-3-4-8-9-0, a total of 14 States. Longest distance covered, 660 miles. How 144mc finishes as a distance-covering band is a matter for conjecture; signals are not reflected by any known medium, but who knows, perhaps we ourselves one day will supply the answer with a reflecting medium of our own.

The 50mc gang experienced their first

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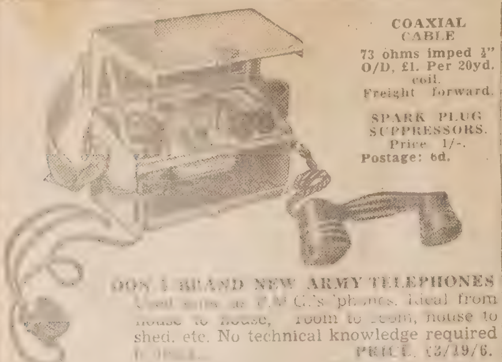

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SOLDERING IRONS:
110v. 240 watt. £1/10/0.
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TRANSCEIVER: TP9. 4.3—6.6 m/cs.
Receiver, 6 valves:
2-VR18, 1-VR27, 2-VR21, 1-VR22.
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1-VT50, 2-VT51.
Complete less batteries,
£4/15/0.
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TRANSCEIVER: TR1196, 3-9 m/cs.
9 Valves: 1-EF50, 1-VT52, 1-VT501, 2-VR53, 1-VR55, 2-VR56, 1-VR57.
New, complete with motor generator.
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12v.	500 watt	£10/10/0

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MOTOR GENERATOR UNITS:
No. 11. H.P. Input 12v. Output 440v. 40 mA.
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Motor Generator: Type E, Input 12v. Output 1200v. 7.5mA. £3/10/-
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AIRCRAFT NAVIGATORS' DRAWING BOARDS:
Complete with Pantograph; useful surveyors, draughtsmen, etc.
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CAMERAS:
Aircraft type F24. 5ms. lens. 5½" x 5½".
Focal Plane Shutter, 5" F4 lens.
PRICE, £15.
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DX for some months, when during a hot spell, the band opened on October 27 at 2135 hours. 2WJ, 2ADT and 2RU working 2ADE of Casino ,and most of the around-Sydney crowd worked 4BT. At 2300 hours VK[illegible] was heard for a short period.

Similar conditions existed on the 28th and 29th, and according to those who listen to the Beacons, the MUF was up to 50mc. On the second day, from 1400 hours onwards, VK1 and VK5 stations were worked, while VK3's were heard.

For about an hour, many VK2's were dancing in their shacks while three VK5's chatted across town discussing the possibility of the band opening for interstate working. When the VK5's decided to listen the band was just closing. What a waste!

DX AND PERSONAL

VKS4 has been playing havoc on 40mx recently, not the main signal, but some spurious emission. They cluttered up about 40 to 50kcs of the low end of the band — some of the chaps have made official complaints.

ZK2AA does the polite thing with the piles that form on him; waits till they have all exhausted themselves calling him and comes up: "Sorry, men, have to go to supper cue."

ISIAFM has been very active on 10 and 20, various frequencies, gives his QTH as Airport, Elmas, Sardinia.

Elusive MD4BPC T7 14080 most mornings spends his time calling CQ—seldom works anyone, except a few close-by Africans.

If you can judge by a description, ZL3CV has one of the most elaborate outfits in the Antipodes, relay remote-controlled transmitters on all bands, which are changed with a throw of a switch—some show.

Our new friends, the K's, are coming on in force these days, just at the moment the prefix is a little strange.

ZC1AZ is anxious to work South Americans; spends a lot of time calling CQ OA/LU and CE/HK. It might work if so many of the DX gang were not key-happy, one dit from an elusive station and the wolves arrive.

MP4BAB 14050 T8 has been a nice contact for a few VK's. Frank, the operator, has been away, and G8IJ has been keeping up the good work. QTH RAF, Sharjah, Trucial Oman, Persian Gulf — promises a QSL, too!

From time to time, W stations have been heard with strange prefixes hung to their normal calls, the latest, W4KJN/G3. The PO may or may not be co-operating.

Getting Started On F.M.

(Continued from Page 59)

This is accomplished by providing composite IF transformers, which have two independent sections to each winding. The upper section of the winding resonates to 10.7 mc, while the lower section, or the two together, resonate to 455 kc. In practice, the smaller section offers little impedance to the flow of current at 455 kc, while the larger section behaves much the same as a decoupling circuit when the operating frequency is 10.7 mc.

The signal frequency circuits are simply switched from FM band to the normal broadcast band, and the IF produced is either 10.7 mc or 455 kc, depending on the operation of the tuned circuits. The IF channel amplifies whichever frequency is applied to it, without need for complicated switching. It's necessary, of course, to change the detector from FM to AM operation.

FRENCH POLISHING

(Continued from Page 81)

Most of the oil will be removed by the spiriting-off process. If too much oil is left on the job the polish will never dry really hard.

The polish or spirit must never be applied to the outside of the rubber, only the oil. The rubber must never be wet, only slightly damp. The practised polisher will gradually allow his rubber to become drier as the process nears completion. Towards the end of the work the rubber will just leave a slight mark if pressed on to a piece of white paper.

Remember that between each coat of polish there must be a period of drying after which the job is rubbed with glass paper. The glass paper must be very fine if scratching is to be avoided, especially towards the end of the work. No. 0 glass paper can be made still finer by rubbing two pieces together. When the polishing is complete the job should be left to stand for several hours before being handled.

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OFF THE RECORD — NEWS & REVIEWS

By JOHN MOYLE

A new and finely recorded "Fire Bird" is the main work among records received this month, together with a Beethoven Sonata, played by a splendid pianist who may be new to records.

SONATA IN E FLAT MAJOR—LES ADIEUX—Op. 81 A (Beethoven) played by ALBERT FERBER. Decca 22927-8.

Most music-lovers, particularly pianists, will agree that this is one of Beethoven's most beautiful piano works, if not the most majestic. It has the reminiscence of earlier works, such as the 'Pathetique' and the 'Waldstein,' but with its own beautiful melodies, and a hint of more weighty works to come.

I liked this performance exceedingly. It is sincerely played with no flamboyance or striving for effects, dramatic or otherwise, and with an exceedingly fine technique. There is restraint coupled with a fluent speed which flashes when required with complete authority.

The recording is somewhat remote, but we must always remember how hard it is to record a piano successfully, particularly when played by someone who commands the full pianistic range of dynamics.

I don't remember hearing this pianist on records before, but I should keep my eye on the list for more if I were you. This example of his work is most encouraging.

THE FIRE BIRD SUITE (Stravinsky) played by the LONDON PHILHARMONIC ORCHESTRA, conducted by ERNEST AUSTERMET. Decca Z924-6.

I must admit that I was somewhat surprised to receive this recording so soon after the release of the Philadelphia set with Stravinsky conducting. My surprise was not great enough to conceal the pleasure with which I listened to them. In fact, the two sets make rather a fascinating contrast in every way.

Frequently I have criticised the Philadelphia orchestra for its use of somewhat dead recording chambers, and its "forward" recording methods. Here, however, we have the undeniable concert hall effect without any great tendency to blurred outlines, and with a most satisfying impression that none of the players have gone home when for the moment they are not required!

There is, I feel, much more subtlety about this presentation than we find in the Philadelphia set. The "Lullaby," for instance, is an exquisite example of sensitive, controlled playing by a fine ensemble. If it does not display as much sheer weight as the earlier release, it is because we seem further away from the players. In this connection I am sorry that the final side is missing from my review set.

The recording is quite wide in range, from a well-rounded bass to a real treble "edge," as you will find out if your amplifier is a good one. It's a pity that a few spots are not quite clear, as I fear so often happens with the best of pressings.

On the whole, I think these records appealed to me as having more music to them than the Philadelphia set. However, you should judge that for yourself.

HENRY VIII DANCES—NELL GWYN DANCES (Pastoral Dance) (Edward German) played by the CITY OF BIRMINGHAM ORCHESTRA, conducted by GEORGE WELDON. Do-3186-7.

Music so well known needs very little comment. It is not only well written as such, but has a melodic merit well above most light music. These records are attractively played in a hall with a reverberation constant a trifle longer than is ideal but which gives a true "hall atmosphere." Technically they are good but not brilliant. They should be popular.

MARY SHAW, MY NANCY—sung by SYDNEY MacEWAN. Columbia DO-3190.

I have always had a great admiration for this fine tenor, who is without a peer in singing simple songs of this type. He has lost little of his prewar unaffected freshness you will remember in many beautiful records. You may also have heard him during his recent visit to Australia.

Other Records Released This Month

COLUMBIA

FRANK SINATRA WITH ORCH.—Nature Boy and Why Was I Born.—DO.3197.

XAVIER CUGAT AND HIS ORCH.—Ok'l Baby Dok'l and Cuanto Le Gusta. DO.3198.

HARRY JAMES AND HIS ORCH.—Forever Amber and Love Of My Life. DO.3200.

DINAH SHORE WITH ORCH.—Daddy Surprise Me and Hooray For Love. DO.3201.

HARRY JAMES & HIS ORCH.—You Can Do No Wrong and Nina. DO.3202.

XAVIER CUGAT AND HIS ORCH.—Charisse and On An Island With You. DO.3203.

DINAH SHORE WITH ORCH.—Golden Earrings and It Was Written In The Stars. DO.3204.

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To JOHN HINTON & CO.,
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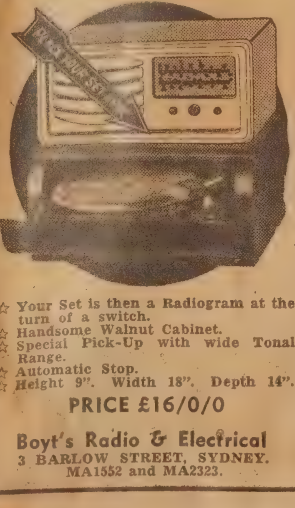

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MA1552 and MA2323.

A SIMPLE MODULATOR

(Continued from Page 63).

plate circuit and gives the plate load an apparent value of several megohms.

As a result, the gain of the pentode rises to something like 1500 times and full output is achieved with a signal input of only 20 millivolts. The increase in gain is at least 10 times or 20db.

Wired in this fashion, the modulator could be used with almost any type of microphone. The single pentode stage gives as much gain as a normal pentode and a normal triode working in cascade.

BYPASS CONDENSER

There are a couple of points to watch, however. The impedance of the plate circuit is so high that very small bypass capacitance will cut heavily into the treble register. If you use the circuit, therefore, it is best to rely on the capacitance of the shielded plate lead for an RF bypass or, at the very most, to use nothing higher than 50 pf.

It is difficult also to connect a tone control in this plate circuit so that the only position for the control is where we have shown it, in the plate circuit of the two output valves.

Since the arrangement gives very much higher overall gain than the conventional circuit it is necessary to be doubly careful about shielding the microphone cable and the input grid circuit. Hum problems are not likely to occur, since the power supply is on a separate chassis.

The circuit is recommended only where it is necessary to cater for a low output microphone. With a high output microphone, overloading is likely to occur in the first valve and, furthermore, the gain control will not be fully effective. The whole idea of the alternative circuit is simply to obviate the need for a special preamplifier stage.

TRANSMITTER CONNECTION

The connection to the transmitter is quite straightforward. The modulator picks up its power from the supply chassis, so that a suitable cable and plug system is required. The switching was covered in detail last month.

A pair of leads from the secondary of the modulation transformer clip beneath appropriate terminals on the transmitter chassis while two parallel leads to the power supply chassis allow the transformer to be shorted out for CW operation.

Next month, if space permits it, we will present an article covering the construction of a suitable rack and outlining the procedure and precautions necessary to put the complete transmitter on the air.

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ANSWERS TO CORRESPONDENTS

B.R.B. (Christchurch, New Zealand) asks a question concerning the use of a particular transformer and rectifier with the "2JU Amateur Five" receiver. Also expresses his satisfaction with the magazine and its contents, even with the increased price.

A. Very pleased to note your interest in the articles contained in R. & H. You could use the 350-volt transformer and [illegible] h the receiver in question, [illegible] to employ choke in[illegible] two reasons. Firstly, [illegible] plate is in excess of the [illegible] for the 6X5 with conden[illegible] and secondly, the [illegible] will reduce the voltage out[illegible] which, after the voltage [illegible] he two filter chokes has been [illegible] ll be very close to the desired [illegible] voltage of the set. A filter of [illegible] input type can be easily visualised if, when viewing the ci[illegible]uit of the [illegible] ateur F[illegible] ou discount the first 16 mfd filter con[illegible] and consider [illegible] lter condenser [illegible] ng included in [illegible] your trans[illegible] ticularly with [illegible] rectifier has [illegible] 6.3 volts and [illegible] be connected to the 6.3 volt winding of the transformer. It may be connected [illegible] 3 volt winding which sup[illegible] The underneath [illegible] ectifier are as [illegible] Heater; pin 3, Plate; [illegible] in 8, cathode. It should be [illegible] same manner shown in the [illegible] with the heater connected [illegible] volt winding and the voltage [illegible] ll be taken from the cathode. [illegible] 5 volt winding [illegible]

[illegible] comments on [illegible]e condenser tester recently described [illegible]d suggests that a switch position should [illegible] included to discharge the condenser [illegible]

A. Many thanks for your suggestion, but the switch position was not provided [illegible] the [illegible] k from a charged condenser, as we feel that any experienced operator would more or less automatically discharge each condenser after test. However, the point you raise is quite a legitimate one.

N.S. (Brisbane, Qld.) asks [illegible] ever described a uranium or [illegible] Radio & [illegible]es, although it is just [illegible]sible that some reference to such a d[illegible] may have been made in the [illegible] Science pages. Sufficient to say [illegible] are not in a position to offer constructional data. The valve you describe could easily be the VR65 or VR65A, which are RF pentodes with a transconductance of about 8000. However, many English valves would fit your description and it is impossible for us to offer any assistance without knowing the actual type number. This normally appears on the envelope.

C.R. (Smithton, Tas.) accepts our invitation to comment on Radio and Hobbies and mentioned particularly that he would like to see greater detail in the photograph blocks.

A.: This has always been something of a problem, C.R., as fine screen blocks are not a success on the poor quality paper which we have been obliged to use. Comparison cannot be made with the other publication you mention, which uses rotogravure printing. However, we have managed to obtain a quantity of higher grade paper which was first used in the August issue. It will make possible much cleaner printing—always providing that the supply holds out. Your other remarks are likewise noted.

F.B. (Kallista, Vic.) wants information about connections to coils, IF transformers, vibrator cartridge and power plugs for the FS6 transceiver.

A.: We have been far too busy in recent years to keep track of all disposals equipment and, although we know a little of the FS6 equipment we would have to make a special search for the information you require.

J.S.C. (Ingham, Qld.) forwards a remittance for 12 months' subscription to R. and H. magazine. Also brings up the question of a set for operation from a 32-volt home lighting plant.

A.: Thanks J.S.C., for your remittance which has been duly dealt with by the subscriptions department. Due to pressure of special activities which have been mentioned in the magazine, we have not as yet been able to complete certain projects, among which is a set for operation from the home lighting plant. We are not able to state definitely when we will be able to publish the necessary data but are hoping that it will not be too long before we are able to do so.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C, GPO, Sydney.

K.S. (Ormond, Vic.) has built a "T.R.F. Majestic" but is in trouble about the bass response.

A.: The original heavy bass appears to have been a combination of cabinet and speaker resonance as there is nothing to cause it in the actual circuit. What you did after that to lose the bass altogether we cannot quite imagine. Almost any of the condensers in the audio section can give reduced bass if it were open circuited internally. It seems, therefore, that you would have to make a thorough check with this in mind. However, your idea of bypassing the cathode of the 6J5 would completely explain the effect, although it is not clear whether this was done before or after variation in bass response was noted. Bypassing the cathode with a .1 mfd condenser would certainly increase the gain considerably but would render one of the 807 valves inoperative, thereby turning the audio end into a rather dubious single-sided affair. Under no circumstances should additions of this nature be made to the circuit.

G.J. (Strathmerton, Vic.) sends a subscription and makes a suggestion about substitute fasteners for "Mini-Max" 67½ volt B-batteries. He removes the top of an old battery and uses it in reverse to plug on to the new battery.

A.: Many thanks for the subscription which has been duly noted. Your suggestion re the use of the old battery connectors as substitutes for the correct type is a very good one and one which other readers will no doubt find of interest. Thanks for the kind remarks and we are pleased to hear that you have done so well with the sets that you have built.

R.S. (Christchurch, NZ) speaks very highly of Radio and Hobbies and in particular, the recent article on the "High Fidelity Five."

A.: We are receiving an increasing amount of correspondence from New Zealand and are glad to note that the magazine is appreciated there. We can see no particular reason why your receiver should drift any more on the local stations than on more distant ones. All oscillators tend to drift a little and the effect becomes more noticeable as the selectivity is increased. It is just possible, of course, that the station in question has been having some difficulty on this account although drift of such an order should not normally occur. Valve manufacturers suggest that the screen and oscillator anode of a 6K8 should be supplied through a common 15,000 ohm 2 watt resistor. You could try this and note whether any improvement is evident. The most likely cause of hum in a five valve set, apart from the filter, is an eddy current effect from the power transformer. Shield the leads between the audio valve and volume control but earth them only near the valve socket. If the leads or shielding are earthed at the other side of the chassis, minute hum voltages can be introduced into the circuit.

J.L.T. (Kogarah, NSW) writes to report success with "Fireside Five" and the "Springtime Portable." He would also like to obtain some information on "Micro-Flash" photographic equipment.

A.: Glad to hear that the sets turned out to be a success. The micro-flash equipment uses a special lamp through which a condenser is discharged. The flash is of much shorter duration than that of the usual flash lamp and is synchronised with the shutter. The color is whiter than that from the conventional types. A single lamp can be used many times. We have no plans at the moment for describing any apparatus of this nature in Radio and Hobbies.

Glad to know the sets were successful.

J. McD. (Hanley Bridge, SA) renews his subscription to Radio and Hobbies and makes a contribution to the "Serviceman Who Tells" articles.

A.: Your subscription receipt should have reached you well before you read this and there is no need to worry about forgetting the renewal when it is due. In the normal way a renewal notice is sent out well in time to avoid missing out on an issue. Glad to note you have appreciated Radio and Hobbies and in particular, the article on the condenser tester.

B.D.H. (Warrnambool, Vic.) asks whether it would be possible to convert a 5-valve a-c receiver to vibrator operation.

A.: It is certainly possible but not very economical unless you happen to be adept at modifying circuits. To do the job properly the present a-c valves would have to be replaced entirely by battery types and due provision made for screen and bias voltages. A vibrator supply would then have to be built and you would end up with a set like the "Vibra Four." The alternative would be to operate the existing valve heaters from 6 volt source, providing a vibrator supply for the high tension. This way the current drain of the set would be much higher, running up to perhaps 4 or 5 amps, depending on the details of the circuit. Regarding your second query you may find that a better aerial or an earth wiring for your set may prevent the fading. Alternatively, it may be traced to a gassy valve or to a grid return resistor much higher in value than it should be.

K.S. (Penshurt, NSW) intends to construct the "Minivox" receiver and he asks us about a mistake in the parts list.

Yes, we are afraid that the value of potentiometer shown in the parts list is incorrect. The correct value is the one shown in the circuit diagram (0.25 meg.). Either a 5000 ohm or 7000 ohm speaker could be used with equal success. Thanks for the kind remarks, K.S., and we hope that you will be successful with the little set.

ANSWERS TO CORRESPONDENTS

R.L. (Auckland, NZ) wishes to build ltra compact version of the "Handie- ie" for headphone reception only. He s to receive Auckland stations from vhere in the north island.

We regret that time will not permit redesign the "Handie-Talkie", especi- for your purpose. However, we e the following few remarks in the that they will serve as a guide to

e R.F. section of the set is already sensitive and you may not find that complication of the R.F. stage war- s the extra bulk entailed. It is im- ble for a set designer to guarantee ption over the distances mentioned, with the most carefully engineered He can design a set to have a cer- sensitivity, selectivity and internal level, but the strength of signals in rtain locality is a factor over which set designer has no control. If the l is below the noise level, no set receive it. With the relative import- of your two requirements in mind, would suggest the most satisfactory ion to the problem is the five-valve die-Talkie" design minus the audio ut stage. The headphones may be ated directly from the audio voltage ifier stage. If you can obtain the gain I.F. transformers, one amplifier would give all the gain usable so the set would then need only three es in all.

R.C. (Cobden, NZ) tells of his ex- nces with vented baffles. He found ecent articles on the subject of value.

Many thanks for your interest and eciative remarks. Since the publica- of the articles you mention we have ed out further experiments with ed inclosures in conjunction with a ate high frequency speaker. We may ble to publish the results of these in ture issue.

M. (Alphington, Vic.) says he has tructed the "2JU-Five" from the h, 1947, issue but has not had much ess with it.

Hard lines about the receiver, K.M., you should be able to get it into ation without too much trouble. There fundamental difference between 465 55 kc. I.F. transformers, since the odd kc. difference can be made up ly by adjusting the cores. The sub- tion of slightly different value con- ers would not make any great dif- nce. As you say, trouble could easily n the coil and with this in mind we d remind you that there was a mix- n the original table, the data for L3 L4 being inadvertently confused. ly reverse the figures under L3 and

F.C. (Orange, NSW) says he has good ts from the "Crystal King" and has it for listening to Test broadcasts.

We are delighted to read of your ess with the "Crystal King" and your eciation of the present series of les for beginners. We note your est also for an explanation of the r picture and will oblige in future s.

B.V. (Sale, Vic.) renews his subscrip- to R. & H. and mentions particularly appreciation of the "Servicemen" les.

s, B.B.V., the "Serviceman Who Tells" proved a very popular contributor to columns. Your letter has been passed o him for further reference. Many ks for your subscription.

B (Kew, Vic.) says he has built up direct-coupled T.R.F. set from the , 1948, issue with excellent results. s most anxious to contact the designer, William Darragh, who has since ed from the address published.

Thanks for your report on this set if Mr. Darragh happens to read this graph, he may care to get in touch you (Mr. W. Bishop, 109 Disraeli t, Kew).

R.W. (Waverley, NSW) asks us about g diagrams for the "Multi-Talkie" also the availability of "Multi-Talkie" ets.

No wiring diagrams were prepared he "Multi-Talkie," the only wiring mation given being a coded under is photograph. However, we do not that you should have any trouble ilding this set if you carefully study hoto in conjunction with the circuit. cabinets for this set should now be able from any of the radio houses tising in the magazine.

P.W.T. (The Oaks, NSW) acknowledges receipt of the June issue and would like to see an index printed regularly.

A.: Thanks for your letter, P.W.T. We included an index for the last volume in the September issue and will continue to publish them each year.

E.C.W. (Christchurch, NZ) sends in the circuit of a one-valve battery-operated shortwave converter for comment.

A.: The main difficulty with battery converter valves operating on the shorter wavelengthes is maintaining reliable oscillation. Also, the stability and gain of the arrangement is not always what could be desired. We will, however, keep your letter in mind in connection with the "Reader Built It" page.

M.J. (Leabrook, S. Aus.) submits two queries, one in connection with the use of the "Super Tuner" (June, 1948) with the "Senior Radiogram" (June, 1947).

A.: The frequency response of the audio end of the "Senior Radiogram" is as good as and, in many cases, better than the response from conventional audio amplifiers. The ultimate quality of reproduction from an amplifier is also dependent on the speaker system. Conventional practice favors a reasonably large speaker mounted in a vented enclosure baffle, either with or without a "tweeter." As far as the frequency response of the Senior Radiogram is concerned, an improvement could be made only with an amplifier like the 807 triode amplifier, which was described in the March and April, 1948, issues of R. and H. The conclusion is, then, that the use of the Super Tuner with an audio end similar to that of the Senior Radiogram and feeding the output into a vented enclosure baffled speaker system would produce results which would satisfy very exacting requirements. The two issues of R. and H. which you mention were delayed by circumstances beyond the control of the editorial staff. Under normal circumstances, each issue is made available for sale on the first Friday of the month in all States. Mailed copies are posted so as to be received on or about that time.

J.H.R. (Murwillumbah, NSW) suggests that an RF signal generator be described in R. and H. and tabulates his ideas about the requirements for such an instrument.

A.: Thanks, J.H.R., for your letter. Your suggested requirements conform rather closely to a particular type of instrument which is available commercially. However, we doubt whether its construction and calibration would be practicable in the home workshop, as there is far more to it than meets the eye.

H.B.H. (Ipswich, NSW) expresses his satisfaction with the performance of the "Fidelity Five," which was described in the May, 1948, issue of R. and H.

A.: We were very pleased to receive your letter, H.B.H., and to note the excellent results which you are obtaining from the above-mentioned set. It indicates results obtained on the prototype models of sets described in the magazine can be duplicated if the normal care in construction is taken.

E.W. (Pilliga, NSW) has just completed the "Little Jim" set and so far has had no results.

A.: No doubt, E.W., you have already carefully checked the wiring of your set and made sure that everything is in order, including the connections to the valve pins. Make sure also that the minus A and minus B of the batteries is connected to the chassis. Under these conditions, oscillation should occur at a particular setting of the reaction condenser as it is turned from the minimum capacitance setting. This oscillation is heard in the headphones as a gentle hiss which will increase in intensity as the condenser is turned further past the point where oscillation commences. If this hiss is not heard, reverse the connections to the reaction winding of the coil and try again. If the set still fails to oscillate, then the fault may be due to the batteries being too low in voltage, the valve may be unserviceable or one of the resistors may be open-circuited. However, once satisfactory reaction has been obtained the set should function quite well. The set is in its most sensitive state when the reaction condenser is set to the point just below where oscillation occurs.

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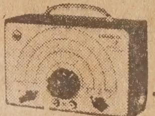

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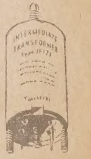

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Wound on Polystyrene Formers, moisture proofed with high frequency lacquer. Can size 1⅜" dia. x 2½" High. 50 mmf. silver mica condenser moulded in base necessary at these high frequencies.

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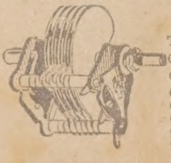

Type	mmfd.	Plates	Price
CV41	10	2	7 3
CV42	15	3	7 9
CV43	25	4	8 4
CV44	35	5	9 0
CV45	50	7	9 6
CV46	70	9	10 0
CV47	100	14	11 3

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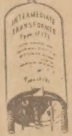

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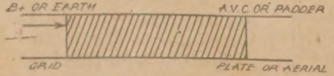

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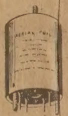

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ANSWERS TO CORRESPONDENTS

G. R. McDonald (Wellington, NZ) is very interested in the 807 triode amplifier, but says that it has limited application in New Zealand, where type 807 valves are neither plentiful nor cheap. He also suggests that we should describe and adhere to a standard power unit for all receivers.

A. It is hard lines about 807 valves, as they are finding a very wide application in this country. On the other hand, the 2A3 and 6A3 is in relatively short supply and costs more than 807. We note your suggestion about grouping of the circuits, and have something of that nature in mind. Regarding the power unit, the idea has only limited application, as it is virtually impossible to obtain a neat result by that method. It might serve for a few of the large amplifiers, but it would take away altogether from the tidiness of smaller receivers to have them operating from a supply almost as large as themselves.

W.B. (Yarraville, Vic.) writes in with a query on a power unit which is intended to supply a battery set.

A.: Well, A.B., from inspection of rectifier voltage curves and calculation of the voltage drop in the filter choke, a suitable value of dropping resistor for an output voltage of approximately 90 volts would be .01 megohm at a rating of 2 watts. This, of course, can be easily arranged by connecting two .02 megohm resistors of 1 watt rating in parallel. Incidentally, another 8 mfd electrolytic filter capacitor would be necessary from the 90 volt side of this resistor to earth. It would be a wise move to check this output voltage under load to ensure that it is close to the desired 90 volts, in case there is a variation in components. The value of dropping resistance has been calculated on the basis of a 10 mA current drain of the set. If the drain is higher, the resistance value can be lower by a proportionate amount and vice versa. It is not practicable to attempt to provide 1.5 volts by means of a dropping resistor from such a comparatively high voltage source. If the valve filaments are connected in series, the change problem is simplified. In the case of the a-c power supply for the "Multi-Talkie" set described recently in the magazine, the filaments of the valves were connected in series, requiring a voltage of approximately 7, and they were supplied via a dropping resistor from a potential of a little over 90 volts. We are hoping to describe in the October issue of R. and H. an a-c power supply for use with sets employing miniature type valves. This supply will meet your requirements completely.

Mr. I. Langshaw (45 Vincent Road, Wangaratta, Vic.) writes in for more information on a B battery power supply described in "A Reader Built It," Jan., 1947, by Mr. Perry, of Brisbane.

A. Unfortunately we have no further information about the power supply and as the original correspondence has been destroyed we can not give you Mr. Perry's address as you request. However, if Mr. Perry reads this column he may care to write directly to you at the above address.

P.A.B. (Lakemba, NSW) would like to see a 1.4v. battery amplifier similar to that described in the November, 1942, issue of R. and H., which used 2v. valves.

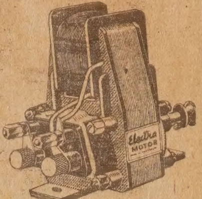
A.: Yes. We agree that an amplifier could be built along this line. However, just when we will be able to find the time and space for such a description is a matter for speculation.

F.S. (Melbourne, Vic.) suggests that we should describe a special tuner unit for use with the 807 Triode Amplifier.

A.: Thanks for your letter, F.S., and for the suggestion. While we have not actually described a unit along the lines you mention, the R. and H. "Super Tuner" in slightly different form should serve the purpose very well. We have no information at the moment regarding the release of record changers with lightweight pickups.

R.S.B. (Adelaide, SA) renews his subscription to Radio and Hobbies and says he is puzzled by the apparent failure of a preamplifier which he has fitted to a five valve dual-wave receiver.

A.: Without knowing any details of the circuit it is well nigh impossible to suggest why the preamplifier is not a success. However, it could be accounted for if the valve is very weak as implied in your letter.



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FOR SALE: 12v. Genemotor, output 500v. 50 M/A, 275v. 110 M/A. Perf. order, £5. **XB3205.**

FOR SALE: 4 watt Amplifier with 10" Speaker and Crystal Pick-up, £12 or offer. **Frank Scambary, Pennant Street, Castle Hill.**

FOR SALE: Hallicrafter Super Sky Rider S17 with matched G12 Speaker and spare valves, £40. **78 Chaleyer St., Rose Bay.**

FOR SALE: 71 copies R. & H. Mainly volumes 3-9 inclusive; also Vol. 1, Nos. 1 & 2; Vol. 2, No. 1; Vol. 6, the only complete volume. **Synnott, 209 Adelaide Terrace, Perth, W.A.**

FOR SALE: Six Rola 3" Speakers. Brand new. With Transformers, 19/- each. **Mr. Kerk, Pennant Hills Rd., next Jones' Garage, Carlingford.**

FOR SALE: Complete set of unused Miniature Valves. Two 1T4's, 1S5, 1R5, 3S4. £4 the lot. **B. Shields, Yea, Victoria.**

FOR SALE: Transceiver (19) with genemotor (Manuel). New 2JU, 35 watt Modulator. New 20 watt Amplifier. 1000 New I.R.C. Resistors assorted. New **FS 6** Transceiver complete. What offers? **J. Gerard, Box 11, Coffs Harbor, N.S.W.**

FOR SALE: Single Gang Cond. Reinartz Coil, Reaction Cond. Valves, 2:30's, 1:1Q5-GT (as new). Sundries including Resistors, Condensors, Switch, Sockets, etc. The lot £2. **N. Ferguson, National Bank, Ayr, N.Q.**

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SALE: AT5, AT4, spares and genemotor, £30; Dynamike, £5; box radio parts, £5; No. 11 Set, Genemotors, £7; Mic. stand, £2; Meters, Relays; 12/1100v. Genemotor, £3; Goodall-Pratt 2" Lathe, motorised, £20. **Simpson, Flat 4, Cross St., Double Bay.**

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SALE: Plessy Record Changer. New. Original carton. Never used. £16/10/-. **R. G. Atkins, 7 Flers Ave., Earlwood, NSW.**

A READER BUILT IT

(Continued from Page 70)

the exact power depending on the percentage of distortion which can be tolerated. A modern, highly sensitive speaker would be necessary to make the best of this limited output power.

For greater output it would be necessary to increase the operating voltage, one scheme being to have a set of high tension accumulators, which are switched in series with the normal line voltage, bringing the operating voltage to about 60, the necessary bias to —3.0 and the available power output to between 250 and 300 milliwatts. When the receiver is not in use the additional batteries are switched back across the main batteries to be recharged.

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Readers wishing to buy, sell or exchange goods are invited to insert an advertisement on this page. The cost is 1/3 per line; approximately 5 words to a line. Advertisements for the next issue must reach our office by WEDNESDAY, NOON, December 15, 1948. Dealers' advertisements not accepted.

SALE: Service Oscillator Kit complete coils and IJ6 valve, £3/10/-. Battery Receiver, 1Q5GT two, less phones, £4/10/-. 3" Kingsley Permag. Speaker, new, £1. 2A5 Valve, 5/-. 4" Dial, complete, 5/-. 83 **Morgan Street, Merewether.**

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